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Physiological reactivity of schizophrenic and control subjects to dimensions of primary intensity of pure tones and of socioemotional significance of words.

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PHYSIOLOGICAL REACTIVITY OF SCHIZOPHRENIC AND CONTROL SUBJECTS TO DIMENSIONS OF PRIMARY INTENSITY OF PURE TONES AND OF SOCIOEMOTIONAL SIGNIFICANCE OF WORDS

A Dissertation Presented

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INTRODUCTION

This study is concerned with the examination of the physiological responses of poor premorbid (PPM) and good premorbid (GPM) schizophrenic subjects to a dimension of sounds and to a dimension of taboo words, and the comparison of their responses with those given by a control group.

Psychological literature is replete with references to studies indicating both extreme variability and either excessive inhibition or lack of inhibition in schizophrenic patients. Hillyer (1926), in an autobiography, for example, traces quite nicely what may be a common course in at least one type of schizophrenia. She reports on her self-observations upon first entering the mental hospital with reference to her normality leaving her as follows (p. 41):

> One of the chief signs lay in the weakening of all inhibitions. . .Primitive impulses had their way. The result was more insidious because almost always there was a hint of the 'watcher', the 'censor' left, just enough to gloat over the show, not enough to control or in any way size up the situation.

As she begins to recover, she indicates the following:

> A kind of stupor settled upon me like a fog, and while there were no longer

lengthy periods of complete oblivion yet most of the time I sensed things dimly. The stupor arose, I think, very largely from physical exhaustion; I lay for days and hours more dead than alive, wanting only to be undisturbed (p. 91). . . .There is no motive, no push of any kind, behind those living in complete despair. Yet despair is in itself kind, if only it be whole-souled. Pain comes when hope appears ever so dimly at its edges (p. 104). . .

I was paying the full price for a slight measure of recovery. I was entering upon a state of keen realization, without as yet any inhibitions or diverting circumstances to mitigate it. But the knife of returning perception cut clean; there was little rancor or wild rebellion from this time on (p. 122). . .Things that I would never have noticed before cut into me like a knife: sounds, smells, mechanical adjustments, telephones, streetcars with various and sundry different kinds of entering contrivances, the latest can opener, the most modern toothpaste top. On the other hand, mat-

> ters that would once have harrowed me had no effect; little annoyances went past me like a spring breeze. Life had been one long annoyance (p. 171)!. . .Yet all the time I was looking at myself as another person might have looked, and I was trying to work out a plan of living, not immediately pleasurable to me, but rational for the person who had so recently emerged. The minute I was able, thus, to get on the outside of the experience and get to look back, face it squarely,--that minute I step into the ring with the rest of my kind (p. 186).

At first she seemed to have lost all control over her inhibitions. This period, or phase, was followed by a stuporous state. Next came a period of keen realization, which seems to have been a phase of reversal in response to stimulus strength. That is, stimuli that previously had not affected her bothered her considerably, while previously disturbing stimuli had no effect on her. As will be discussed more fully below, her reactions were remarkably similar to those observed by Pavlov in animals subjected to high levels of stress in the laboratory.

Thompson (1947), in reporting on concentration camp prisoners, indicated that the occurrence of the usual types of mental illness was as would be expected in a normal population. Suicide and prison psychoses were absent. However, almost every one of the prisoners developed a condition of marked inertia. That is, their interest could not be aroused and they did very little work in the camp. Upon the news of their impending liberation, they became excited, and then, once again, let down.

The work done by Galambos (1959) elucidates certain aspects of inhibition which may be of some value for an understanding of the inhibitory reactions observed in schizophrenic patients and people in extremely stressful situations. He implanted electrodes in the cortex and in the first auditory synapse, the cochlear nucleus, of a cat, and studied electrical activity in both areas in response to a metronome oscillating at the rate of eleven beats in three minutes. The measured responses became very small over a period of several days. However, when shock was presented on the eleventh click the responses returned to their large size, and only gradually became smaller again. After the procedure was repeated a number of times, mere introduction of the cat into the experimental room was sufficient to produce the larger responses. Galambos concluded that the strength and duration of the stimulus is not as important as the "selective attending" of the animal to the stimulus. Additionally, response gradients as a function of degree of attention occurred not only in the cortex, but also in the cochlear nucleus, suggesting that selective inhibitory phenomena can occur at the peripheral level of the nervous system. This suggests that in certain pathological states, peripheral inhibition may be used as a defense against involvement with, or stimulation by, the environment. Hernandez-Peon (1964) has reported that excitability of the flexor spinal reflexes is significantly decreased to shock during hypnotically suggested anesthesia of the forearm. He also indicated that functional subcortical sensory blocking in a hysterical patient was released by barbituates.

Experimental studies of schizophrenic patients suggests that they differ from normals in responsiveness to stimulation. For example, Hoch, Kubis and Rouke (1944) reported that, when nine personally disturbing questions based upon the person's case history were asked of their subjects, the schizophrenics gave either no GSR or a small GSR, while control subjects gave large GSRs. Jurko, Jost and Hill (1952), using the Rosenzweig Picture Frustration Test as a representation of interpersonal stress, reported that their schizophrenic subjects were less reactive than their controls on a GSR measure. Reduced GSRs in schizophrenics is not reported for all types of stimuli. For example, Paintal (1951) observed that although schizophrenic subjects gave smaller GSRs than normal subjects to the threat of electric shock, the schizophrenics and the controls gave similar GSRs to the actual electric shock. Selective GSR responsivity to different classes of stimuli was also noted by Bergeron (1964). He noted a tendency for good premorbid schizophrenics to give smaller GSRs than controls to TAT-like cards with emotion-laden content, while their GSRs were as large as those of the controls to pictures which were emotionally neutral. In addition, the GSRs of schizophrenics who had had a poor premorbid adjustment were smaller than those of the controls to both emotional and nonemotional stimuli. Sologub (1960) examined GSRs of schizophrenics to verbal stimuli which related to their illness, and to lights of different intensities. He reported that while responses to the light stimuli increased with intensity, responses to the verbal stimuli tended either to be small to the emotionally significant stimuli and large to the neutral stimuli, or to be the same for both kinds of stimuli. From these studies it would appear that certain schizophrenics tend to be normally reactive to the physical component of stimulation, but abnormally unreactive to the socioemotional implications of stimuli.

Venables (1964a), in discussing physiological activity, reactivity, and attention in schizophrenics, concludes that the acute patient is low in activation, high in reactivity, and unable to restrict his field of attention. As a result, he is deluged with stimulation: "Items of all kinds have equal importance and the meaningfulness of the external world tends to be lost for the opposite reason to that which applies with the chronic patient" (Venables, 1964a, p. 41). With respect to the chronic schizophrenic, he believes that a high level of cortical and sympathetic activation produces a restricted attentional field.

Pavlov's (1928) explanation of schizophrenia, which is based on concepts of excitation, inhibition, and their interaction, would seem to account for many of the above observations. Following extreme excitation that resulted in massive inhibition of reactions, which Pavlov referred to as the phase of "transmarginal inhibition", several other phases of balance between inhibitory and excitatory processes were described by Pavlov as subjects returned to their pretrauma manner of responding to stimulation. The phases he described, following the transmarginal inhibitory phase are: (1) ultraparadoxical (inhibitory or negative stimuli produce responses, but positive stimuli do not); (2) paradoxical (weak stimuli elicit strong responses and strong stimuli elicit little or no response); (3) equalization (the amplitudes of the organism's responses remain constant, i.e., they do not vary as a function of the strength of the stimuli); and (4) normal functioning (the organism's responses to stimuli vary as a function of the strength of the stimuli as they did prior to the traumatization). Within Pavlov's theory, the acute schizophrenic, or good premorbid (GPM), can be viewed as being in an early phase of unrestrained excitability, while the chronic patient, or poor premorbid (PPM), can be viewed as in a phase of general inhibition. The paradoxical phase corresponds to the findings in some studies that schizophrenics may produce large or normal responses to weak stimuli and weak or no responses to strong stimuli (Bergeron, 1964; Sologub, 1960).

Mednick (1958), following the learning theory approach of Hull, has also attempted to deal with the different stages of activation observed in acute and chronic schizophrenics. He describes the acute stage as one of heightened drive in which the schizophrenic differs from others in three ways. For one, the acute schizophrenic presumably more readily acquires conditioned responses due to his high arousal, or drive state, which increases response strengths of all habits associated with the given situation. A second way in which the aroused schizophrenic differs from less aroused individuals is in his presumably broader generalization gradient, which follows directly from his high drive state. The third difference between acute schizophrenics and others lies in the schizophrenic's reduced ability to deal with complex learning tasks. This, Mednick suggests, occurs because correct responses must compete with incorrect habit tendencies which have been raised above threshold by the high drive state.

The acute stage leads to the chronic stage in which activation is lowered when the schizophrenic experiences a reduction in anxiety as a result of producing remote associations, which are, thereby, reinforced. As a result the individual continues to display inappropriate behavior as it allows him to reduce his anxiety. The adjustment is poor from Mednick's viewpoint, not only because it maintains the disorganized behavior, but also because it does not deal with the potential anxiety. Thus Mednick (1958) states, "It may be important to note that even the chronic patient is in one sense a very anxious person. He has never had the opportunity to extinguish his pre-psychotic fears. They are still elicitable; all that is required is that one break through the schizophrenic's 'associative curtain'" (p. 324).

Within the Hullian framework, but emphasizing a ceiling factor rather than a threshold factor to account for disorganization, is the work of Broen and others (Broen, 1966; Broen and Storms, 1966; Broen, Storms and Goldberg, 1963). Like Mednick they suggest that inappropriate behavior, such as abnormal stimulus generalization is the result of an increase in the reaction potential of competing responses due to the individual being in a high state of drive. They contend that once habit strength and arousal have raised the dominant response to its ceiling, further arousal will only increase the strength of competing responses. This decreases the probability of the occurrence of the originally dominant response and increases the probability of the occurrence of the initially weaker competing responses. They support their contentions by showing that even as a non-aversive drive increases, the stimulus generalization gradient of a trained response showed reduction of the dominant response at the training stimulus while the same response increased in strength to the less similar stimuli. They suggest that response disorganization occurs in both acute and chronic schizophrenic functioning, but that chronic schizophrenics attempt to cope with their disorganized response hierarchy by restricting their observations.

In contrast to most arousal theorists who have studied schizophrenic functioning and then established theories to account for it, Epstein (in press) investigated anxiety, and, on the basis of his theory of anxiety, derived a theory on schizophrenia. He suggests that the essential characteristic of schizophrenic functioning is an inadequately modulated system for controlling arousal or excessive inhibition. That is, the schizophrenic has not developed an adequate inhibitory system for controlling excitation. Therefore, the schizophrenic may be overresponsive or underresponsive depending on the amount of control he is capable of exerting at the time of the stimulation.

STATEMENT OF THE PROBLEM

The present study was primarily undertaken to examine physiological reactivity of schizophrenics to different intensities of stimulation. Since responses of schizophrenics may vary as a function of type of stimuli, socioemotional stimuli and stimuli varying in primary intensity were used. The three main characteristics of physiological functioning examined are: general level of arousal, general reactivity, and variation in reactivity as a function of variation in stimulus strength. As arousal and reactivity are not wholly unitary concepts, several response measures are investigated, including several indicies of the galvanic skin response, basal conductance level, finger movement, verbal reaction time, and respiration.

Arousal theorists differ in their views on the general level of physiological arousal in schizophrenia. Additionally, their estimations are usually dependent upon whether the schizophrenic is acutely or chronically disturbed.

Mednick (1958) suggests that the acute schizophrenic is in a state of high arousal. He conceives of the stabilized, chronic schizophrenic as having reduced his level of arousal through associations that are remote from reality and anxiety arousing cues.

In contrast, Venables (1964a) suggests that the acute schizophrenic is in a state of low, and the chronic schizophrenic in a state of high, arousal. Additionally, he suggests that schizophrenics who show a great deal of social withdrawal are more aroused than schizophrenics who are more socially involved.

The present study was designed so that the general level of physiological arousal of schizophrenics could be compared as a function of the chronicity of their illness, their degree of social withdrawal, and their premorbid classification. Since Mednick's predictions are based on assumptions that are somewhat questionable (Lang and Buss, 1965), and since Venables' predictions are based on empirical findings employing measures similar to those used in this study, it was predicted, following Venables, that acute schizophrenics would be less aroused than chronic schizophrenics, and that the less socially withdrawn schizophrenics would be less aroused than the more socially withdrawn schizophrenics. A prediction on the basis of premorbidity was not made, since neither theorist worked directly with that variable and since there is some suggestion that the premorbidity and the chronicity variables should be considered separately (Higgins and Peterson, 1966).

Physiological reactivity to stimulation is generally found to be reduced in chronic schizophrenics. Venables (1964a) suggests that a low resting level of arousal in acutely disturbed schizophrenics produces a high level of reactivity, and that a high resting level of arousal in chronic patients produces a low level of reactivity.

Epstein (in press) suggests that the basic characteristic of schizophrenic functioning is an inadequately modulated inhibitory control system for excitation, so that schizophrenics can be underresponsive, overresponsive, or vary between the two extremes of responsiveness.

The intensity of physiological reactivity in schizophrenics may depend on the type of stimuli. Paintal (1951) and Sologub (1960) found that a group of schizophrenics who were similar to controls in their responsiveness to the primary intensity value of stimuli were less responsive than controls to the acquired intensity values of stimuli. Bergeron (1964) noted that a group of good premorbid schizophrenics who were inadequately responsive to emotion-laden stimuli were as responsive as control subjects to neutral stimuli.

Since Venables' suggestion of reduced physiological reactivity in chronic schizophrenics is fairly generally supported (Lang and Buss, 1965), it was predicted that chronic schizophrenics would be less reactive than acute schizophrenics and controls to primary stimuli and, following Paintal and Sologub, would be increasingly less reactive to stimuli whose intensity values were acquired. There was no basis in previous findings and theory on which to make predictions concerning the relationship between reactivity and premorbidity of schizophrenics.

With respect to variation in reactivity as a function of variation in stimulus strength, Epstein's (in press) theory of schizophrenia suggests that the magnitude of the reactions of schizophrenics fails to follow the stimulus intensity dimensions as closely as normals. Gradients thus can be deviant either in the same direction for the group as a whole, or with reference to individual departures from the group mean for the different levels of stimulus intensity. Schizophrenics could be either less responsive, more responsive, or vary to a greater extent, than normals. The suggestion would hold for both primary stimuli and stimuli with acquired intensity values. According to this theory, it would be predicted that the magnitude of the reactions of schizophrenics would fail to follow the stimulus intensity dimension as closely as normals. The prediction would be confirmed if all the schizophrenic types investigated were low in reactivity, if all were high in reactivity, or if some were high and others low.

METHOD

Subjects. Three groups of right-handed male subjects between the ages of nineteen and forty-three were used in this study. Two were patient groups composed of fourteen subjects each, and the third was a control group of fourteen subjects. Each of the patients was hospitalized at Fairfield Hills Hospital, Newtown, Connecticut and diagnosed as schizophrenic. Their participation in the study was voluntary. Their clinical records contained no evidence of brain damage, mental deficiency, cerebral surgery or vascular disorders, but the patients were receiving drug therapy. The patients used were initially divided into two groups on the basis of their premorbidity ratings on the criteria set forth by Phillips (1953). Each patient rated good premorbid (GPM) had a score of fifteen or less, and each patient rated poor premorbid (PPM) had a score of sixteen or greater on the Phillips' premorbidity scale. The mean score for the GPM group was 9.1 with a range from 1 to 14, and for the PPM group the mean was 23.1 with a range from 16 to 30 (see appendix A). The patients were later pooled and redistributed on other variables as described below.

The control group was composed of psychiatric aides at the same hospital. Their service was voluntary and without compensation.

An attempt was made to match the three groups on age, education, and vocabulary (see Table 1). T-tests were carried out on the means and in two instances significant differences were found. The GPMs were significantly (.01 level) older than the PPM patients, and the control group had a vocabulary score that was significantly (.05 level) higher than the score of the GPM group. These findings occurred even though each available GPM patient entering or in the hospital over approximately a two year period was evaluated for use in the study, and even though extra control subjects were tested. Similar trends occurred in an earlier study using similar populations at a different hospital (Bergeron, 1964), suggesting that GPM patients tend to be older than PPM patients, and that GPM patients score less well than control subjects on vocabulary even though their educational levels are similar. Since age and premorbidity score were restricting factors, several hundred clinical records had to be examined to obtain the patients used in this study. The vast majority of available patients at the state hospital were PPMs. The control group was composed of subjects from the same institution because of their availability and because of the difficulty in moving the polygraph equipment.

The vocabulary score was obtained on the Shipley-Hartford Retreat Scale (Shipley, 1940).

Table 1

Comparison of Good Premorbids, Poor Premorbids and Normal Controls on Age, Education and Vocabulary

	Age		
Group	Mean	Range	S.D.
Control	28.4	21-43	8.3
G P M	33.5	21-43	7.2
P P M	25.4	19-43	6.7
	Education		
	Mean	Range	S.D.
Control	11.0	9-14	1.8
G P M	11.3	8-16	2.1
P P M	11.2	8-15	2.2
	Vocabulary Score		
	Mean	Range	S.D.
Control	30.2	27-36	2.5
G P M	25.9	12-33	6.0
P P M	27.1	18-34	5.2

Seven members of each group received words first and tones second, while the remaining seven of each group received the reverse order. Assignment of subjects to sequences was random, except that they were balanced for age, education and vocabulary score.

Following the analysis based on premorbidity, the patient population was pooled and redistributed into the eight low, eight medium and eight high scorers on each of six variables. The variables were: Length of Hospitalization, Paranoid Tendencies, Social Withdrawal, Motoric Withdrawal, Drug Dosage, and Initial Basal Conductance Level. Within each of the three groups of eight patients, four patients received words first and the remaining four received tones first. Length of Hospitalization was scored as the cumulative amount of time spent in the hospital for all hospitalizations of the patient. The Paranoid Tendencies, Social Withdrawal and Motoric Withdrawal measures were all based on scales derived from work done by Venables and his co-workers (Venables, 1957, 1963; Venables and O'Connor, 1959; Venables and Wing, 1962). See appendix B for the scale used in measuring Social Withdrawal (Venables, 1957) and appendix C for the scale used in measuring Paranoid Tendencies (Venables and O'Connor, 1959). Actually, combinations of scores on items obtained from both scales were used to obtain the Social Withdrawal and the Motoric Withdrawal measures. The means, ranges and standard deviations for each level of the four variables are presented in Table 2. In the scoring system of Venables, low scores on the Social Withdrawal Scale reflect social withdrawal while higher scores reflect greater social involvement. The Motoric Withdrawal Scale was scored in a similar way in that low scores reflected motoric withdrawal while higher scores reflected a greater degree of motoric activity. In order to avoid confusion, the patients who are low, medium and high in actual degree of social withdrawal will be designated as the low, medium and high levels, respectively, of the Social Withdrawal variable in this study. The same designation will apply for the levels of the Motoric Withdrawal variable. On the Paranoid Tendencies Scale, a low score is associated with little manifestation of paranoid tendencies while a high score indicates prominent use of paranoid tendencies.

The Drug Dosage variable is concerned with the degree to which the medication the patients were receiving might influence their psychotic traits and their physiological reactivity. In order to determine the effect of medication, a record was kept of the type of medication, the dosage, the length of time it had been administered, and recent changes in these factors for each of the patients. A listing of these factors was made and submitted to the psychiatrist who had prescribed medication for most of the patients. He was given the following instructions:

Table 2

Means, Ranges and Standard Deviations for Length of Hospitalization, Paranoid Tendencies, Social Withdrawal and Motoric Withdrawal Variables

Variable	Level	Means	Range	S.D.
Length of Hospitalization	High	45.5 mos.	24.9-75.9 mos.	17.6 mos.
	Medium	13.4 "	8.8-20.3 "	3.9 "
	Low	4.8 "	3.0- 7.8 "	4.0 "
Paranoid Tendencies	High	12.8*	10.0-16.0	1.9
	Medium	6.8	5.0- 9.0	1.3
	Low	4.0	4.0- 4.0	0
Social Withdrawal	High	16.1*	13.0-19.0	1.7
	Medium	19.8	18.0-21.5	1.5
	Low	24.0	21.0-27.5	2.4
Motoric Withdrawal	High	7.4*	7.0- 8.5	0.6
	Medium	8.9	8.5- 9.5	0.3
	Low	11.7	10.0-14.5	1.7

*These values represent scores obtained on scales designed to measure the variable under consideration. For a further explanation of their meaning refer to the Test Materials section of the text.

In a study entailing measurements of reaction time, respiration rate and the galvanic skin response, patients had been on drug dosages for a specified length of time on the day they were tested. The purpose of the study was to investigate differences between schizophrenics and controls on the above measures to different intensities of stimulation. However, it is felt that the drugs the patients were receiving may have reduced their "psychotic traits" and/or their physiological responsiveness. It is, therefore, desirable to divide the medications into three groups with at least eight of the medications in each.

One group (Group One) would be for those medications expected to have a profound effect on the patient's functioning. In the second group (Group Two) would be those medications having a moderate effect in reducing the patient's "psychoses" and/or physiological responsiveness. In the third group (Group Three) would be placed those medications having only a slight effect on the patient. This group would include doctor's orders for no medications.

In establishing the above three groups, please rank the medications within the groups in order of their potency. That is, the one expected to be most potent for a given group would be placed first, and the least potent in a given group placed last. Finally, please indicate how much of an overlap you believe exists amongst the groups. For example, would the group with the medications expected to have only a moderate effect on the patients be more like the group of medications expected to have a profound effect on them, or more like the group expected to have little or no effect on them? If you have any questions, suggestions or remarks, please note them on the last sheet or mention them to me.

Those patients placed in the low level of the Drug Dosage variable were receiving medications expected to have little effect on their psychotic traits and physiological reactivity, while those placed in the high level of the Drug Dosage variable were receiving medications expected to have a profound effect in reducing their psychotic traits and their physiological reactivity.

Placement of patients into the low, medium or high Initial Basal Conductance Level categories was dependent upon their conductance level following the instructions for the first half of the test, but prior to the presentation of any of the word list or tone list. The Initial Basal Conductance Level is measured in micromhos. The patients in the low Initial Basal Conductance Level category have a mean conductance of 3.57, a range of 2.39 to 5.00, and a standard deviation of 0.90; those in the medium level have a mean conductance of 5.64, a range of 3.88 to 7.98, and a standard deviation of 1.26; and those patients in the high Initial Basal Conductance Level category have a mean conductance of 9.98, a range of 6.00 to 13.37, and a standard deviation of 3.03 micromhos. The overlap between the medium level group and each of the extreme groups was necessitated by the need for a balanced design. That is, of the eight patients in the medium group, four had to have received word stimuli first and four pure sound stimuli first.

Test Materials. A multiple-choice test of vocabulary, the Shipley-Hartford Retreat Scale, was used to obtain the vocabulary scores.

The Paranoid Tendencies score for each patient was obtained by following Venables and O'Connor (1959) and summing the scores the psychiatrist assigned to the patient on items 2, 4, 6 and 8 of the Paranoid Tendencies Scale (see appendix C). The possible range was 4 to 20, with a score of 6 or below considered to be nonparanoid (Venables, 1963).

The Social Withdrawal Scale score was obtained following Venables (1963) by using the scores to items 6, 7, 9 and 10 of the Social Withdrawal Scale (see appendix B) and items 1 and 5--scored in the opposite direction--of the Paranoid Tendencies Scale (see appendix C). Scoring of the form was done by both the patient's ward charge and the patient's psychiatrist. The mean of their scores was the patient's score on the Social Withdrawal variable. The possible range was 6 to 30, with a score of 15 or below indicative of social withdrawal (Wing, 1961).

The total Motoric Withdrawal score for an individual was obtained by summing the scores to items 1, 3 and 8 of the Social Withdrawal Scale with the score to item 9 of the Paranoid Tendencies Scale (Venables and O'Connor, 1959). Each individual was rated on the variable by both his psychiatric aide and his psychiatrist. The mean score of the two raters was the total Motoric Withdrawal score for the individual. The possible range was 4 to 20, with a low score reflecting motoric withdrawal.

A Grass Model 5D Polygraph was used to record the electrical skin response, finger movement, respiration, and reaction time. Grass Model E-1B Durable Disc Electrodes were used to obtain the electrical skin response measurement. Bentonite paste, made according to the formula given by Woodworth and Schlosberg (1954), was used to reduce polarization and to facilitate electrical contact. Two electrodes were attached to each subject, one to the index finger and one to the middle finger of the subject's left hand. After the indentations of the electrodes were filled with bentonite paste, the electrodes were secured to the plantar sides of the third phalanxes of the subject's fingers with adhesive tape.

The finger movement measure was obtained using a Grass Model FT.03B Force Displacement Transducer. During testing the subject placed his right index finger in a hoop which was attached to the transducer above the subject's hand.

A Phipps and Bird chest pneumograph was used to activate a Grass Model PT5A Volumetric Pressure Transducer to obtain the respiration measure.

All stimuli were tape-recorded and presented to the subjects over Koss Stereophones, Model SP-3. The tape was played on a Revere Model T-3000 Tape Recorder and fed into the headset via a Koss T-5 Junction Box. The experimenter monitored the presentation of the stimuli and manually operated a pen marker to record reaction time with the Grass Polygraph.

The word association list, in the order of presentation used in this study is given below. All critical words are underlined, and neutral words are followed by (N), words of medium emotion-arousing ability by (M), and words of strong emotion-arousing ability by (S). The list used was as follows: quiet, citizen, sand, hunger, music, tiger, wagon (N), pink, angry (M), dog, masturbate (S), king, soft, bowel movement (S), joy, cat, carrot (N), black, afraid (M), swiss cheese, paper (N), town, sex (S), rhinocerous, white, kiss (M), hammer, penis (S), slow, thirsty, embrace (M), hill, carpet (N), red, table (N), swift, rectum (S), bitter, sky, girl friend (M), book, woman (M), heavy, mother (S), butter, boy, curtain (N), and yellow. There was a thirty-second interval between words, and the first word was preceded by, and the last word followed by, a sixty-second interval on the tape. The first sixty-second interval and the first six words were used to allow the subject to adjust to the situation. These were followed by six presentations of N, M, and S words with one buffer word following each N and M word, and two buffer words following each S word. The buffer words were of neutral emotion-arousing ability, and they were inserted between experimental words to allow subjects time to recover from a reaction to an experimental word before the presentation of a second experimental word. Responses to them were not scored as were the responses to the experimental words. The experimental words were randomly assigned to their positions in the list, except that each group of three consecutive experimental words in the order of presentation had to include a N, M, and S word. This allowed for a reasonable distribution of the different categories of words as well as making it possible to subdivide the total list of words into balanced halves, allowing for an examination of adaptation effects. The words were primarily selected from lists used in clinical practice (Rapaport, et al, 1946) and in previous GSR studies (Smith, 1922; Bergeron, 1961). Additionally, three students nearing completion of the requirements for the Ph.D. degree in clinical psychology and a person with considerable experience beyond the obtainment of the Ph.D. were asked to categorize twenty-four words in which the eighteen experimental words were intermixed on the basis of the presumed ability of the word to arouse an emotional response in an individual. There was unanimous agreement on the categorizing of the vast majority of the experimental words, with the few not unanimously agreed upon classified in the expected manner by three out of four of the judges.

The experimental tones used in this study ranged from 400 to 1400 cycles per second (cps). The upper frequency was selected as the highest frequency that does not have a large decibel loss with aging. That is, the elevation in threshold for a 1400 cps tone for a fifty year old person averages less than 10 decibels (Licklider, 1951). The lower limit of 400 cps was selected to allow for five subjectively equal pitch intervals (mels), which are also relatively equivalent in frequency intervals (Osgood, 1953). The actual frequencies of the six experimental tones were 400, 560, 770, 990, 1200 and 1400 cps. Buffer tones extended from 250 mels above to 250 mels below the limits of the experimental tones, corresponding in frequency to 175 and 1950 cps, respectively. Each of the six experimental tones was presented once at each of the three intensity levels. The tones were randomly assigned to their positions with limitations corresponding to those previously arrived at for the word association list. That is, the six sets of N, M and S stimuli were so arranged as to allow the complete list to be subdivided into two balanced halves of three sets each. The three intensity levels of the tones used in this study were selected after reviewing the studies of Plutchik (1962) and of Davis, Buchwald, and Frankman (1955). Both reported linear increases in the size of the GSR as a function of intensity of the sound. Plutchik (1962) reported that the average pain threshold level, which he used as his "high intensity", was 120 decibels (db). He used 110 db as his "medium intensity" stimulus and 100 db as his "low intensity" stimulus. Sears and Zemansky (1952) also indicated that 120 db corresponded to the pain threshold. However, Davis et al (1955) found significant differences in GSR magnitude for 70 db and 90 db intensities (.05 level) and 90 db and 120 db intensities (.001 level). In order to preclude using an injurious stimulus, while maintaining a stimulus dimension that would result in a relatively linear response gradient, the highest intensity used in this study was set at 110 db, the medium intensity at 90 db, and the neutral and buffer stimuli at 70 db. The order of the frequencies employed, with the experimental tones underlined and low intensity, 70 db, indicated by (N), moderate intensity, 90 db, by (M), and high intensity, 110 db, by (S) was: 800, 1090, 1950, 270, 1750, 290, <u>400</u> (N), 1500, <u>770</u> (M), 1850, <u>990</u> (S), 1700, 1900, <u>1200</u> (S), 1090, 205, <u>770</u> (N), 880, <u>560</u> (M), 235, <u>1400</u> (N), 1660, <u>400</u> (S), 290, 190, <u>1200</u> (M), 355, <u>560</u> (S), 1800, 1550, <u>400</u> (M), 670, <u>990</u> (N), 270, <u>1200</u> (N), 310, <u>1400</u> (S), 480, 1750, <u>990</u> (M), 1600, <u>1400</u> (M), 220, <u>770</u> (S), 175, 1300, <u>560</u> (N), and 1950. The tones, each of one second duration, were tape-recorded with thirty-second intervals between them. No tones were presented during the first and last 60 seconds of the tape. The tones were generated by an Eico Model 377 Audio Generator, and recorded on a Model T-3000 Revere tape recorder. Sound level intensity was established by placing the cup-like earpiece of the Koss Stereophone Model SP3 over the non-direction sensing unit of a Model 1551-A General Radio Sound-Level Meter.

<u>Procedure</u>. All of the subjects were tested in the office of the experimenter. When the subject arrived at the office, the experimenter introduced himself and told the subject that

a research study was being carried out and would take approximately one-and-one-half hours. The experimenter then asked the subject his name, date of birth, years of formal education, marital status, and occupation. All subjects were able to give this information without difficulty. The subjects were then told that their participation was voluntary and that questions concerning the nature of the research would be answered at the end of the session. Only one subject--a patient who wanted more specific information--chose at this point not to participate in the study.

The subject sat on one side of a dividing screen that prevented his viewing the polygraph and the tape recorder during the testing. The directions and instructions to the subjects were as follows:

"Now, I am going to attach some leads to you that will in no way harm you, but that will help me to measure what your body does. The leads will not influence you or hurt you in any way.

"First I am going to clean off some of the perspiration and skin oil from two of your fingertips so that the leads will make a good connection. Please let me see your left hand. (The leads were then taped on the fingertips of the subject.)

"Now I am going to slip this bellows around your chest. It will not hurt you in any way. Is that comfortable? (No subject indicated any discomfort with the bellows.)

"Now place your right index fingertip in the hoop on the blue saddle. Good.

"In a moment I am going to place this headset (at this point the experimenter showed the headset to the subject) on you so that you can listen to what I present to you without being disturbed by other sounds.

"Now I want you to sit back and remain as quiet as possible. All right?"

If the word list was to be presented first, the following was said:

"Good. Now I am going to play for you a series of about fifty words. When you hear a word, I want you to respond by saying the first word you think of as quickly as you can, and--<u>as you say it</u>--I want you to press down on the saddle with your right index fingertip. If you are not sure of the word you hear, respond to the word you think you hear. Be sure to press down with your fingertip as you say the first word you think of. And say your word loud and clear so that I can hear you over there. Okay, let's begin."

If any word was responded to in a manner suggesting that it might have been misunderstood, an inquiry about the word was conducted following presentation of the word list.

Between the presentation of words and tones (or tones and words) the following was said:

"Okay, stay seated, but you can take a five minute break now. Then we'll continue with some other taped presentations. You may smoke if you wish to."

If the tones were to be presented next, these directions were followed:

"Good. Now I am going to play to you a series of about fifty tones. After you hear a tone, press down on the saddle with your right index fingertip. Okay, let's begin."

At the end of the testing session, the following was used as a guideline:

"Okay, we are just about finished. Did anyone mention this research to you?"

No discussions which might have been of significance for the purposes of the study were reported.

"Do you have any thoughts on what this research might be about? Do you have any questions concerning this study?"

Questions concerning the equipment and procedure were answered, but no direct statement of the purposes of the study was made. However, if the subject showed interest, he was asked to contact the researcher at the completion of the study for a discussion of the findings.

At the end of the experiment each subject was told:

"As you can understand, it takes time to run an experiment like this, and if a person knows about it beforehand, it can change how he will react. So, I would like to ask you not to mention this study to anyone else, unless you let me know beforehand. Okay?"

The only major change in the above directions occurred when tones were presented first and words second, in which case the instructions concerning words and tones were simply interchanged.

The experimenter wrote down verbatim responses to the word association list, and took notes on as much of the subject's behavior as possible.

Scoring. An Initial Basal Conductance Level score was obtained for each subject following the instructions for the first half of the testing session, but prior to the presentation of any of the word, or sound, stimuli. It was measured in micromho units.

Seven other measures of electrical skin conductance were examined. Four were associated with the immediate increment in response produced by stimulation, i.e., the galvanic skin response (GSR); and three were related to the relatively longer-lasting effects, i.e., basal conductance level.

The GSR was scored as the first change in conductance to occur between one-half of a second and six seconds following the presentation of a stimulus. It was measured by taking the prestimulus conductance level and subtracting it from the greatest conductance level obtained prior to stabilization of, or a reversal in, the direction of the initial response. This measure was scored in micromhos times 10^4. It was apparent that decreases in the conductance level during the interval were due to recovery from strong prestimulus responses and that any new responses of significant magnitude could overcome these decreases. Therefore, decreasing conductance responses during the interval were given GSR values of zero. In order to eliminate the effects of individual differences in GSR reactivity, a second GSR measure analysis was conducted in which rank order values were substituted for GSRs in conductance units. Rank order scores were obtained within subjects by assigning ranks of from 1 to 6 to each subject's six GSR scores.

The remaining two measures associated with the GSR measure were time measures. The first, referred to as the Latency Measure, was the time in seconds from the presentation of the stimulus to the initiation of a GSR. The second, referred to as the Recruitment Time Measure, was the time in seconds from the beginning of the increase in conductance level following stimulation to the point where the conductance level once again began to show a decrease.

All basal level conductance measures were scored in units of micromhos times 10^4. The Basal Level Measure was obtained by taking the lowest conductance level to occur in the interval following the initial GSR to a stimulus and preceding the presentation of the next stimulus. The Basal Level Change measure was obtained by subtracting the prestimulus basal level from the Basal Level.

A third measure associated with basal conductance level was Time to Recovery of Basal Level. It was obtained by taking the time in seconds from the presentation of the stimulus to the point of the lowest conductance level after the initial GSR.

The finger movement response was scored in five different ways. Burtt (1936), who examined many different ways of evaluating finger movement, indicated that the time interval by which the finger movement precedes the verbal response is the best index of emotional disruption. This will be referred to as Anticipatory Motor Response Time and was measured in seconds. The four other measures employed were all based upon Luria's (1932) assumption that finger movement disruption is a reflection of a breakdown in control. Total Motor Response Time consists of the time in seconds from the beginning of the finger movement response to the end of the finger movement response, regardless of whether or not the finger movement preceded the verbal response. This measure does not include the time interval from the end of the presentation of the stimulus to the beginning of actual finger movement. The Total Motor Response Time is a measure of the length of time of actual finger movement and does not include the latency of its occurrence which is discussed below as Motor Reaction

Time. The Positive Motor Response Time Measure was the length of time of actual finger movement that followed the beginning of the subject's verbal response. It was measured in seconds. If the absolute value of the Anticipatory Motor Response Time is added to the Positive Motor Response Time, the Total Motor Response Time is obtained. The Algebraic Motor Response Time was the fourth finger movement measure. It was obtained by subtracting the Anticipatory Motor Response Time from the Positive Motor Response Time, and it indicated the magnitude by which the Anticipatory Motor Response Time exceeded, or was exceeded by, the Positive Motor Response Time. A fifth finger movement measure was Motor Reaction Time, scored as the time in seconds from the end of the presentation of the stimulus to the beginning of actual finger movement.

Verbal Reaction Time Measure was scored by taking the time in seconds from the end of the presentation of the stimulus to the beginning of the subject's verbal response. This measure was evaluated for the word stimuli only since there were no verbal responses to the tones.

The two respiration measures scored were the Poststimulus Respiration Rate in cycles per minute and the Respiration Rate Change. The latter was obtained by subtracting prestimulus respiration rate from poststimulus respiration rate. An attempt was made to derive both prestimulus and poststimulus respiration rates from the time for five continuous breathing cycles to occur prior to and following the stimulus. Because of movement artifacts, the respiration rate sometimes had to be based on only two continuous breathing cycles. This occurred in only six percent of the scores. Although meaningful findings on respiration rates have been based on only a single breathing cycle (Davis, Buchwald, and Frankmann, 1955), at no time was respiration rate in this study based on fewer than two continuous breathing cycles. The respiration measures were employed, since it has been found that respiration rate tends to increase directly with excitement (Woodworth and Schlosberg, 1954) and since respiration rate has been reported to discriminate between schizophrenics and normals (Malmo, R. and Davis, J., 1956; Pishkin, V. and Hershiser, D., 1963; and Williams, M., 1953).

The actual scores entered into most analyses consisted of the median value of the three responses to each stimulus level within each half of the test. In some instances, where there were not three scores in a given stimulus level because a word was not heard or was clearly misunderstood, or because of an artifact in the recording, estimated scores were substituted. Only two measures, GSR Latency and GSR Recruitment Time, required estimates for several cells. This was so because when no GSR occurred there was, of course, no latency or recruitment value for the cell, and entering a score of zero for latency to a nonexistent GSR would make no sense.

Estimated values were computed for the missing cells following the method described by Snedecor (1956).

RESULTS

The data in this study were analyzed in three major ways. First, a simple-randomized design was used to determine differences in Initial Basal Conductance means between good and poor premorbid schizophrenics and normal controls, and, also, to determine differences in Initial Basal Conductance means between the schizophrenics who scored low, medium, and high on the schizophrenic population variables listed below. Second, in comparing good and poor premorbid schizophrenics and normal controls, a 3 x 2 x 3 x 2 factorial design was employed to examine the main effects and interactions of diagnostic group (3 levels), order of presentation (2 levels), stimulus level (3 levels), and test halves (2 levels). Third, in place of the premorbidity variable the schizophrenic population used in the study was separately divided into the low, medium and high scorers on Length of Hospitalization, Paranoid Tendencies, Social Withdrawal, Motoric Withdrawal, Drug Dosages, and Initial Basal Conductance Level. Then a 3 x 2 x 3 x 2 factorial design was used to examine the main effects and interactions of each of the above schizophrenic population variables (3 levels) with order of presentation (2 levels), stimulus level (3 levels), and test halves (2 levels).

Comparison of Good Premorbids, Poor Premorbids and Normal Controls

Electrical Skin Conductance. Analysis of the Initial

Basal Conductance data (Table 3) revealed a significant (.05 level) difference between diagnostic groups. Inspection of the means in Table 4 indicates that the GPM schizophrenics had the lowest mean Initial Basal Conductance and the normal controls the highest mean Initial Basal Conductance.

Analysis of variance of the GSR measure in conductance units (Table 5) indicated that the diagnostic groups differed significantly in reactions to word stimuli (.001 level). The diagnostic groups also differed significantly in reactions to tone stimuli (.05 level). Tables 6 and 7 indicate that the difference was due to the greater responsiveness of the control group than the two schizophrenic groups. It should be noted that all groups were more responsive to sound stimuli than to word stimuli. The interaction of diagnostic group x stimulus level was also significantly different for word (.001 level) and sound stimuli (.05 level). Tables 8 and 9 and Figures 1 and 2, indicate that this was due to the control subjects showing a greater increase in responsiveness as a function of increases in the stimulus dimension than the two schizophrenic groups, who are very similar to each other.

Individual differences in GSR reactivity were eliminated by rank ordering the responses of each subject for stimuli representing all levels and including both test halves. Thus, all groups necessarily have the same mean rank across dimen-

Table 3

Initial Basal Conductance in Micromhos Analysis

Source of Variance	SS	df	MS	F
Between Groups	104.6	2	52.3	4.35*
Within Groups	468.0	39	12.0	
Total	574.6	41		

* .05 level of significance

* * *

Table 4

Mean Initial Basal Conductance in Micromhos of Diagnostic Groups

Group		
Control	GPM	PPM
9.25	5.39	7.51

Table 5

Galvanic Skin Response in Micromhos Times 10^4

Analysis for Word Stimuli

Source of Variance	ss	df	MS	F
Between Groups				
G(diagnostic group)	1,526,590,494	2	763,295,247	9.29***
O(order of presentation)	1,931,125	1	1,931,125	-
GO	86,057,500	2	43,028,750	-
Ss/GO	2,957,197,409	36	82,144,372	-
Within Groups				
H (test halves)	153,086,007	1	153,086,007	13.98***
HG	8,584,519	2	4,292,259	-
HO	5,828,290	1	5,828,290	-
HGO	2,549,932	2	1,274,966	-
HSs/GO	394,208,302	36	10,950,231	-
L (stimulus level)	647,710,680	2	323,855,340	45.44***
LG	286,053,924	4	71,513,481	10.03***
LO	16,427,463	2	8,213,731	-
LGO	21,066,842	4	5,266,711	-
LSs/GO	513,076,173	72	7,126,058	-
HL	79,769,829	2	39,884,915	7.91***
HLG	43,434,659	4	10,858,665	-
HLO	12,863,546	2	6,431,773	-
HLGO	20,514,376	4	5,128,594	-
HLSs/GO	362,892,581	72	5,040,175	-

*** .001 level of significance

Table 6

Mean GSR in Micromhos of Diagnostic Groups for Word Stimuli

Group		
Control	GPM	PPM
0.82	0.29	0.30

* * *

Table 7

Mean GSR in Micromhos of Diagnostic Groups for Sound Stimuli

Group		
Control	GPM	PPM
0.99	0.44	0.48

Table 8

Mean GSR in Micromhos for the Interaction of
Diagnostic Group by Stimulus Level
for Word Stimuli

Group	Stimulus Level		
	Neutral	Medium	Strong
Control	0.46	0.78	1.21
GPM	0.20	0.29	0.38
PPM	0.20	0.28	0.43

* * *

Table 9

Mean GSR in Micromhos for the Interaction of
Diagnostic Group by Stimulus Level
for Sound Stimuli

Group	Stimulus Level		
	Neutral	Medium	Strong
Control	0.27	0.65	2.06
GPM	0.08	0.27	0.96
PPM	0.07	0.21	1.16

Figure 1

Mean GSR in Micromhos for the Interaction of

Diagnostic Group by Stimulus Level

for Word Stimuli

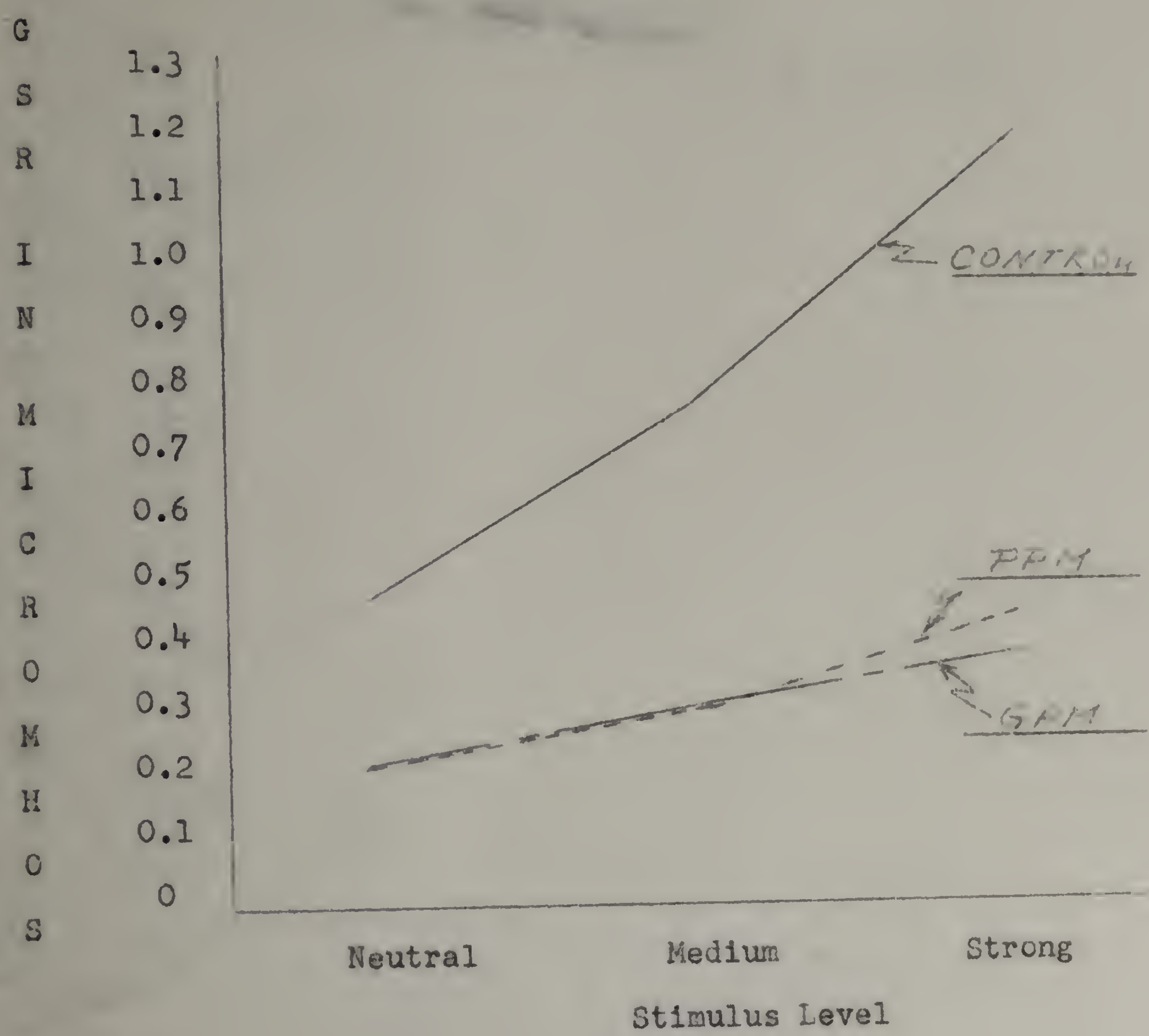
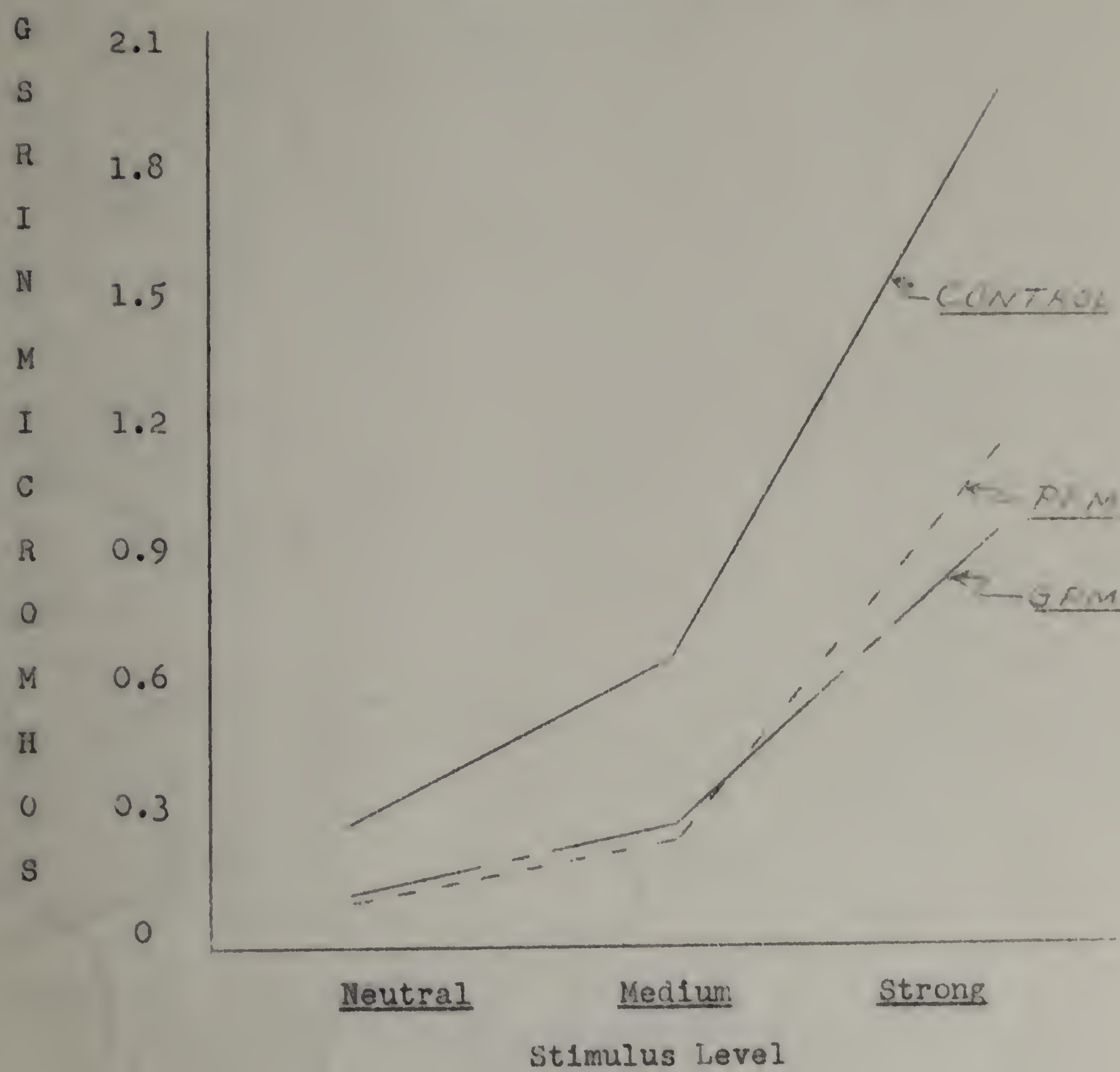


Figure 2

Mean GSR in Micromhos for the Interaction of

Diagnostic Group by Stimulus Level

for Sound Stimuli



sions, and the data of interest consists of the steepness of the gradients. Analysis of variance of GSR Rank Order indicated that the interaction of diagnostic group x stimulus level remained significant (.001 level) only for word stimuli. Table 10 and Figure 3 indicate that both schizophrenic groups showed a considerably flatter gradient to the dimension of word stimuli than the control group. The PPM group produced a slightly steeper gradient than the GPM group.

The diagnostic groups differed significantly (.05 level) on the GSR Latency measure for both word and sound stimuli. Tables 11 and 12 reveal that the control group had the shortest GSR Latency, and the GPM and PPM groups were similar in their longer latency to both types of stimuli.

Analysis of GSR Recruitment Time revealed a significant (.01 level) interaction of diagnostic group x stimulus x level x test half for sound stimuli. Figure 4 and Table 13 indicate that the control group showed a reduction to all stimuli over test halves. In contrast, the GPM and PPM groups showed marked reductions to neutral stimuli, but generally longer Recruitment Times to the medium and strong sound stimuli from the first to the second test half.

Analysis of Basal Level revealed a significant difference between diagnostic groups for both word (.01 level) and sound stimuli (.05 level). Tables 14 and 15 indicate that the findings are due to the control group having had a higher basal

Table 10

GSR Mean Rank Order for the Interaction of Diagnostic Group by Stimulus Level for Word Stimuli

Group	Stimulus Level			
	Neutral	Medium	Strong	Total
Control	1.8	3.6	5.1	10.5
GPM	3.1	3.6	3.8	10.5
PPM	2.7	3.6	4.2	10.5

Figure 3

GSR Mean Rank Order for the Interaction of

Diagnostic Group by Stimulus Level

for Word Stimuli

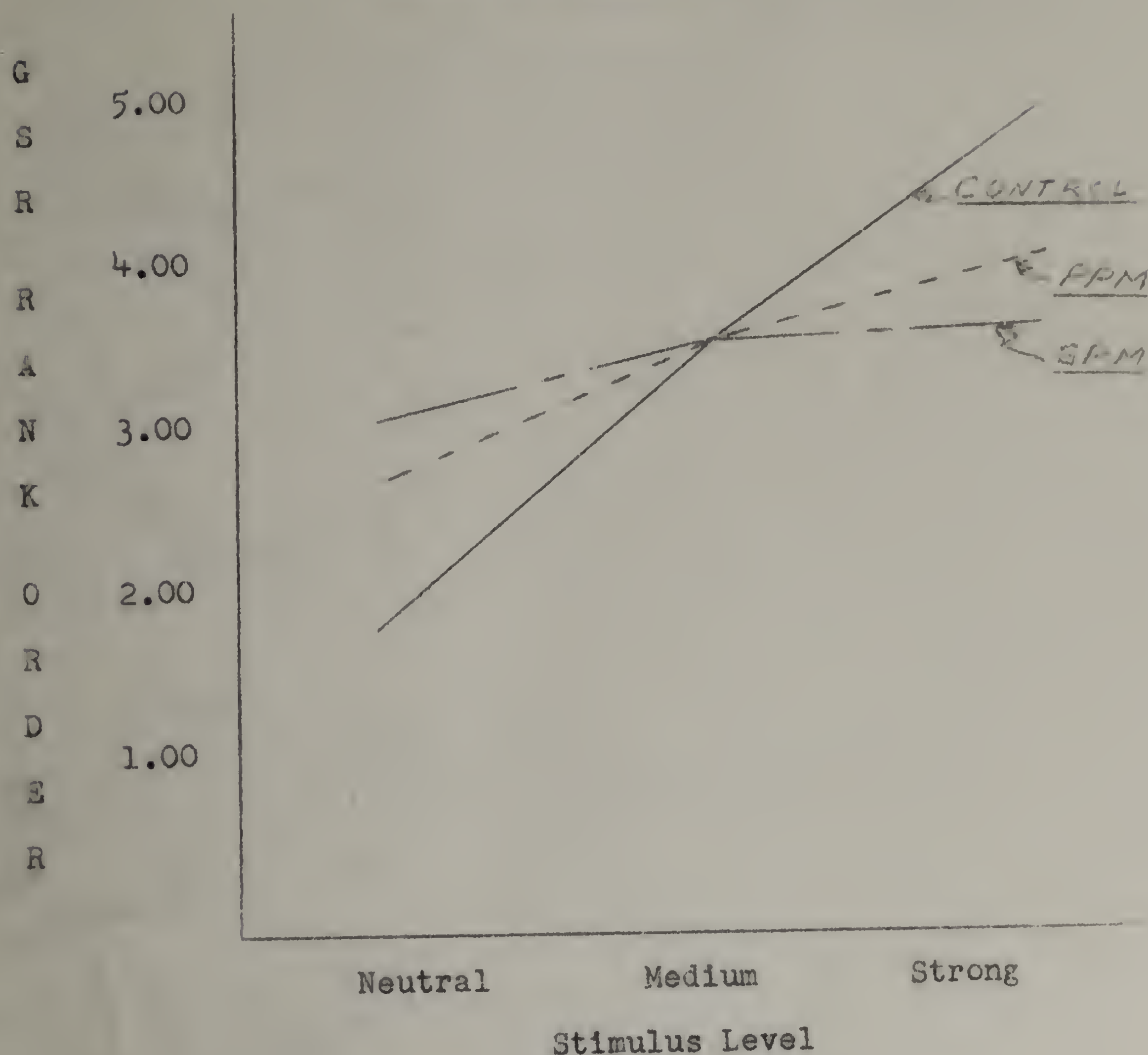


Table 11

GSR Mean Latency in Seconds of Diagnostic Groups for Word Stimuli

Group		
Control	GPM	PPM
1.6	2.3	2.0

* * *

Table 12

GSR Mean Latency in Seconds of Diagnostic Groups for Sound Stimuli

Group		
Control	GPM	PPM
1.9	2.4	2.2

Figure 4

GSR Mean Recruitment Time in Seconds for the Interaction of Diagnostic Group by Stimulus Level by Test Half for Sound Stimuli

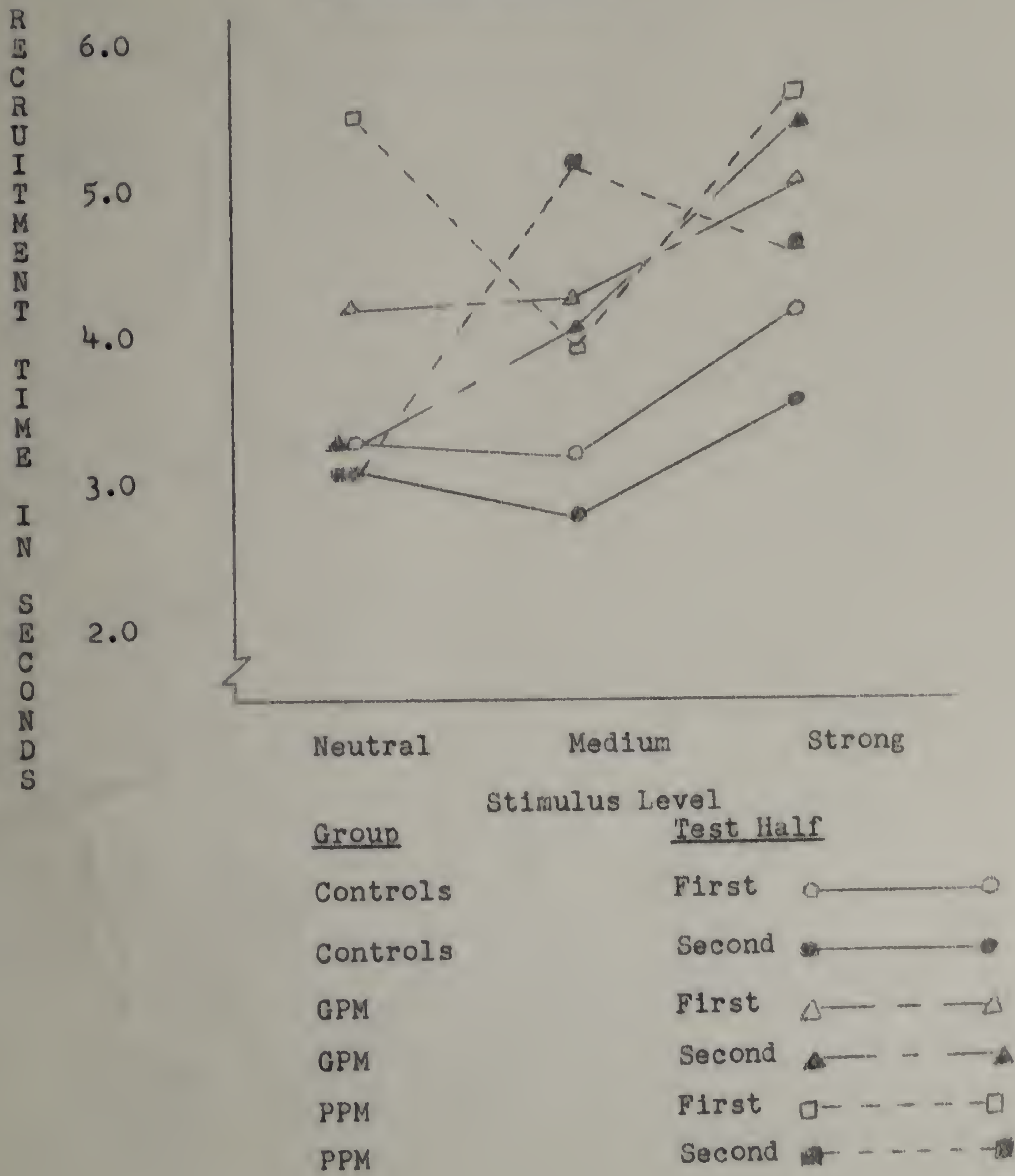


Table 13

GSR Mean Recruitment Time in Seconds for the Interaction of Diagnostic Group by Stimulus Level by Test Half for Sound Stimuli

Group	Test Half	Stimulus Level		
		Neutral	Medium	Strong
Control	First	3.3	3.2	4.2
	Second	3.1	2.8	3.6
GPM	First	4.2	4.3	5.1
	Second	3.3	4.1	5.5
PPM	First	5.5	4.0	5.7
	Second	3.1	5.2	4.7

Table 14

Mean Basal Level in Micromhos of
Diagnostic Groups for
Word Stimuli

Group		
Control	GPM	PPM
9.81	5.57	7.20

* * *

Table 15

Mean Basal Level in Micromhos of
Diagnostic Groups for
Sound Stimuli

Group		
Control	GPM	PPM
9.56	5.52	6.98

conductance level than the two schizophrenic groups. It is noteworthy that the mean basal conductance level of the PPM group is considerably greater than the mean basal conductance level of the GPM group.

Analysis of Basal Level Change in micromhos revealed a significant (.05 level) diagnostic group x stimulus level interaction for word stimuli. Inspection of Table 16 and Figure 5 indicates that the schizophrenic groups compared to the control group showed little change in the difference between prestimulus and poststimulus conductance levels as a function of the stimulus dimension. The GPM group produced the least variation as a function of the stimulus dimension.

Finger Movement. The Algebraic Motor Response Time Measure analysis revealed a significant (.01 level) difference between diagnostic groups for word stimuli. The means in Table 17 show that the PPM group had a predominantly positive finger movement disturbance time, and that the control and GPM groups did not differ in their predominantly anticipatory finger movement disturbance. The diagnostic groups were also significantly different (.01 level) on the Positive Motor Response Time Measure for word stimuli.

Inspection of the means in Table 18 indicates that the PPM group had the greatest amount of finger movement disturbance time following the verbal response, while the control and GPM groups were similar in their shorter finger movement

Table 16

Mean Basal Level Change in Micromhos for the Interaction of Diagnostic Group by Stimulus Level for Word Stimuli

Group	Stimulus Level		
	Neutral	Medium	Strong
Control	- 0.16	- 0.03	+ 0.18
GPM	- 0.06	- 0.02	+ 0.01
PPM	- 0.08	- 0.04	+ 0.05

Figure 5

Mean Basal Level Change in Micromhos for the Interaction of Diagnostic Group by Stimulus Level for Word Stimuli

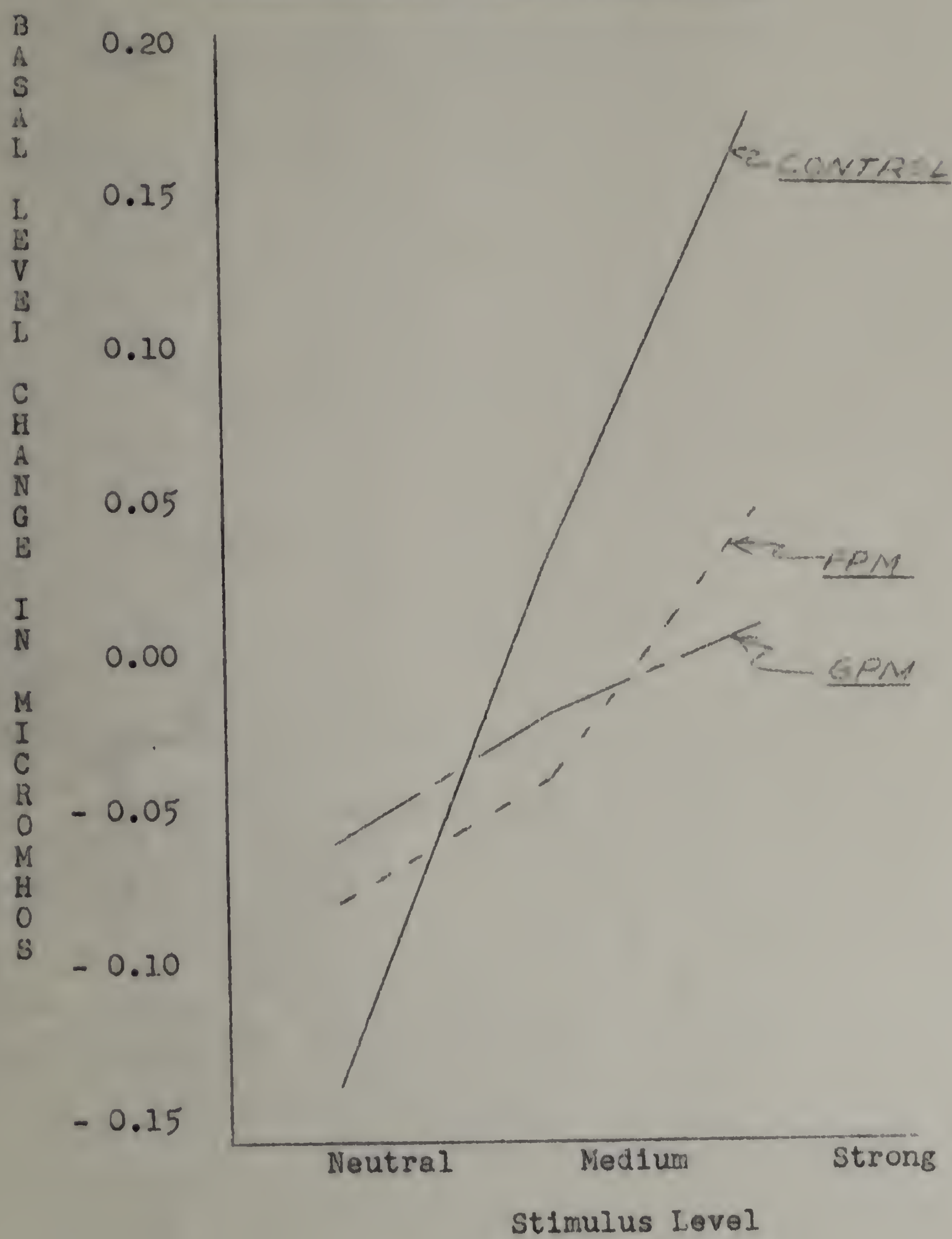


Table 17

Mean Algebraic Motor Response Time in Seconds of Diagnostic Groups for Word Stimuli

Group		
Control	GPM	PPM
- 0.7	- 0.7	+ 0.1

* * *

Table 18

Mean Positive Motor Response Time in Seconds of Diagnostic Groups for Word Stimuli

Group		
Control	GPM	PPM
0.5	0.5	1.1

disturbance time following their verbal responses. Since the diagnostic groups did not differ significantly on the Anticipatory Motor Response Time Measure, and since the Algebraic Motor Response Time Measure was obtained by subtracting the Anticipatory Motor Response Time Measure from the Positive Motor Response Time Measure, it may be seen that in this instance it was the significant Positive Motor Response Time Measure that is of importance, while the significant Algebraic Motor Response Time Measure finding is simply a reflection of the Positive Motor Response Time Measure.

Verbal Reaction Time. There were no significant findings on Verbal Reaction Time which involved diagnostic groups.

Respiration. Analyses of the respiration measures revealed a significant (.05 level) interaction of diagnostic group x test half for the Respiration Rate Change Measure for sound stimuli. The means are presented in Table 19. The GPM group displayed little difference in Respiration Rate Change following stimulation over test halves. The control group, however, showed a positive poststimulus minus prestimulus change in respiration rate during the first half of the test, and a negative change in respiration during the second half of the test. In contrast, the PPM group showed a negative poststimulus minus prestimulus change in respiration rate during the first half of the test and a positive change in respiration rate during the second half of the test. The interaction

Table 19

Mean Respiration Rate Change (Poststimulus-Prestimulus) in Cycles per Minute for the Interaction of Diagnostic Groups by Test Half for Sound Stimuli

Group	Test Half	
	First	Second
Control	0.6	- 0.6
GPM	- 0.2	0
PPM	- 1.0	0.6

of diagnostic group x test half for the Poststimulus Respiration Rate Measure was also significant (.01 level) for sound stimuli. Inspection of the means in Table 20 indicates that the control group has a relatively low and constant respiration rate following stimulation from the first to the second half of the test while the GPM schizophrenics showed little change over test halves and the PPM schizophrenics decreased in respiration rate following stimulation from the first to the second half of the test. Integrating the results of the findings for Respiration Rate Change and Poststimulus Respiration Rate for sound stimuli, it seems that the control group showed adaptation in their reactivity to stimulation from the first to the second test half, while the PPM schizophrenics displayed a greater amount of reactivity. However, in overall poststimulus respiration rate, the control group had a low, stable respiration rate across test halves, and that the PPM schizophrenics, who were much higher in poststimulus respiration rate, showed a reduction from the first to the second test half in their poststimulus respiration rate.

Analysis of variance tables for all the measures examined with premorbidity as the major variable are presented in appendix D. Due to the complexity involved in their interpretation third order and higher interactions have not been presented in the text.

Table 20

Mean Poststimulus Respiration Rate in Cycles per Minute for the Interaction of Diagnostic Groups by Test Half for Sound Stimuli

Group	Test Half	
	First	Second
Control	17.4	17.9
GPM	19.8	19.6
PPM	22.0	20.4

In addition to the above analyses, comparisons of the variances of subjects within the control group, the GPM group, and the PPM group were carried out for subjects nested within order S/O, the interaction of subjects by test half within order, SH/O, the interaction of subjects by stimulus level within order, SL/O, and the interaction of subjects by test half by stimulus level within order, SHL/O. The results of the comparisons are presented in appendix E. On most of the electrical skin response measures, the GPM and PPM groups were more homogeneous in reactivity than the control group. Comparisons of the variances of the subjects in each of the groups for the SL/O interactions indicated that both groups of schizophrenic subjects displayed little variance in their relatively low level of responsiveness over the stimulus dimension in comparison to the variance of the normal control subjects.

The similarity of the variances of the schizophrenic subjects in comparison to the variance of the normal control subjects which was found for the autonomic, or smooth muscle, system was not found for measures reflecting the more voluntary, or striped muscle, system. That is, the variances of the GPM and PPM schizophrenic subjects were significantly different from each other, and from the variance of the normal control subjects, on the Verbal Reaction Time, Poststimulus Respiration Rate, and Respiration Rate Change Measures. The

PPM subjects showed the greatest amount of variance and the GPM subjects the least amount of variance with the variance of the normal control subjects between the two, but closer to that of the GPM subjects. The variances of the subjects examined for the SL/O interaction also revealed significant differences as a function of the diagnostic group to which the subjects belonged. The PPM subjects had the greatest amount of variance over the dimension, with the normal control subjects displaying much less variance, and the GPM subjects the least variance of the three groups.

Comparison of Schizophrenics Divided According to a Number of Subject Variables

Length of Hospitalization. Analyses of the electrical skin response data revealed two significant interactions of interest. For GSR, in micromhos, the interaction of length of hospitalization x order of presentation was significant at the .05 level for word stimuli. Inspection of the means in Table 21 indicates that the patients with a medium length of hospitalization were the most reactive and showed little change from order one to order two, that is, regardless of whether word stimuli came before sound stimuli, the first order of presentation, or whether word stimuli came after sound stimuli, the second order of presentation. In contrast, patients with both shorter and longer lengths of hospitali-

Table 21

Mean GSR in Micromhos for the Interaction of Length of Hospitalization by Order of Presentation for Word Stimuli

Group	Order of Presentation	
	First	Second
High	0.26	0.42
Medium	0.61	0.59
Low	0.14	0.44

zation showed much greater reactivity for the second order of presentation than for the first order of presentation. Since the difference in reactivity amongst the groups is smaller during the second order of presentation, that is, when word stimuli follows sound stimuli, it may be that the sound stimuli results in groups initially low in reactivity becoming more reactive to word stimuli while the groups initially high in reactivity is uninfluenced by the sound stimuli. The normal controls showed a slight increase from the first to the second order of presentation, as do the groups with short and long lengths of hospitalization. The second significant (.01 level) interaction was that for the length of hospitalization x test half interaction for the GSR Rank Order Measure for sound stimuli. Examination of the means in Table 22 show that the group with the medium length of hospitalization showed a small drop in their rank order values from the first to the second test half. Their change was identical to that of normal controls. In contrast, the group with the shortest length of hospitalization had the greater portion of their rank order value occur to the first half of the test. This suggests a fatigue or loss of interest effect rather than an adaptation effect, since the difference between test halves was so much greater for them than it was for normal controls. The group with the longest period of hospitalization showed no difference in the first and second half of the test.

Table 22

GSR Mean Rank Order for the Interaction of Length of Hospitalization by Test Half for Sound Stimuli

Group	Test Half	
	First	Second
High	3.5	3.5
Medium	3.7	3.3
Low	4.1	2.9

The analysis of Anticipatory Motor Response Time revealed a significant (.05 level) interaction of length of hospitalization x order of presentation for word stimuli. The means in Table 23 indicate that the group with a medium length of hospitalization decreased in magnitude of Anticipatory Motor Response Time from the first to second order of presentation, as did normal controls, while the extreme groups were similar to each other in showing an increase in the magnitude of Anticipatory Motor Response Time from the first to the second order of presentation. A second finger movement measure, the Motor Reaction Time, revealed a significant (.05 level) interaction of length of hospitalization x test half for word stimuli. The means are presented in Table 24. Inspection of the means reveals that the group with the medium length of hospitalization increased in motor reaction time from the first to the second half of the test, while the motor reaction time of both extreme groups decreased, as did the motor reaction time of the normal controls, from first to second test half. The medium group had the fastest motor reaction time to the first half of the test and an increase might have been expected. However, the normal controls had an even faster motor reaction time to the first test half and still decreased to the second test half. The means also revealed that the group with the longest period of hospitalization showed the largest reduction in motor reaction time from the first to the second

Table 23

Mean Anticipatory Motor Response Time in Seconds for the Interaction of Length of Hospitalization by Order of Presentation for Word Stimuli

Group	Order of Presentation	
	First	Second
High	- 0.8	- 1.2
Medium	- 1.6	- 0.9
Low	- 0.6	- 1.4

Table 24

Mean Motor Reaction Time in Seconds for the Interaction of Length of Hospitalization by Test Half for Word Stimuli

Group	Test Half	
	First	Second
High	2.0	0.8
Medium	1.0	1.2
Low	2.5	2.2

test half.

The length of hospitalization groups differed significantly (.05 level) in Respiration Poststimulus Rate for sound stimuli. The means in cycles per minute presented in Table 25 show that the schizophrenic group with medium length of hospitalization had the highest Poststimulus Respiration Rate and the group with the longest length of hospitalization had the smallest Poststimulus Respiration Rate. The Poststimulus Respiration Rate of the group with the longest length of hospitalization was only slightly larger than the Poststimulus Respiration Rate of the normal controls.

In summary, patients with a medium Length of Hospitalization tended to be more excited and to show poorer adaptation than did normal controls and patients with shorter and longer periods of hospitalization.

Paranoid Tendencies. Analysis of the GSR revealed a significant (.05 level) interaction of paranoid tendencies x test half for word stimuli. The means are presented in Table 26. Most prominent is the high initial response and the large reduction in reactivity from the first to the second half of the test for the schizophrenic group with moderate paranoid tendencies.

The Analysis of GSR Recruitment Time revealed a significant (.01) interaction of paranoid tendencies x stimulus level for word stimuli. Examination of the means for the

Table 25

Mean Poststimulus Respiration Rate in Cycles per Minute of Length of Hospitalization Groups for Sound Stimuli

Group		
Low	Medium	High
20.3	23.6	18.1

* * *

Table 26

Mean GSR in Micromhos for the Interaction of Paranoid Tendencies by Test Half for Word Stimuli

Group	Test Half	
	First	Second
High	0.30	0.24
Medium	0.54	0.25
Low	0.14	0.10

interaction presented in Table 27 and Figure 6 reveals that schizophrenics with a high incidence of Paranoid Tendencies gave an inverted V-shaped gradient to the stimulus dimension while the schizophrenics low and medium on Paranoid Tendencies gave monotonic gradients to the stimulus dimension. In responding with monotonic gradients to the stimulus dimension, the schizophrenics low and medium on Paranoid Tendencies reacted in a manner similar to that of normal controls (see Figure 1).

Analysis of Anticipatory Motor Response Time revealed a significant (.05 level) difference among the groups to sound stimuli. As can be seen in Table 28, the schizophrenics who employ Paranoid Tendencies the most have the smallest magnitude of Anticipatory Motor Response Time while the schizophrenics who were low or moderate in use of Paranoid Tendencies had equal magnitudes of Anticipatory Motor Response Time.

In summary, the schizophrenics with the highest incidence of Paranoid Tendencies were relatively stable in their moderate level of arousal. However, in most instances, the groups low and medium in Paranoid Tendencies performed more like normal controls than did the group high in Paranoid Tendencies.

Social Withdrawal. The interaction of social withdrawal x test halves was significant (.05 level) for Motor Reaction

Table 27

GSR Mean Recruitment Time in Seconds for the Interaction of Paranoid Tendencies by Stimulus Level for Word Stimuli

Group	Stimulus Level		
	Neutral	Medium	Strong
High	4.0	4.8	4.6
Medium	3.1	3.9	5.1
Low	4.3	4.5	5.2

Figure 6

GSR Mean Recruitment Time in Seconds for the Interaction of Paranoid Tendencies by Stimulus Level for Word Stimuli

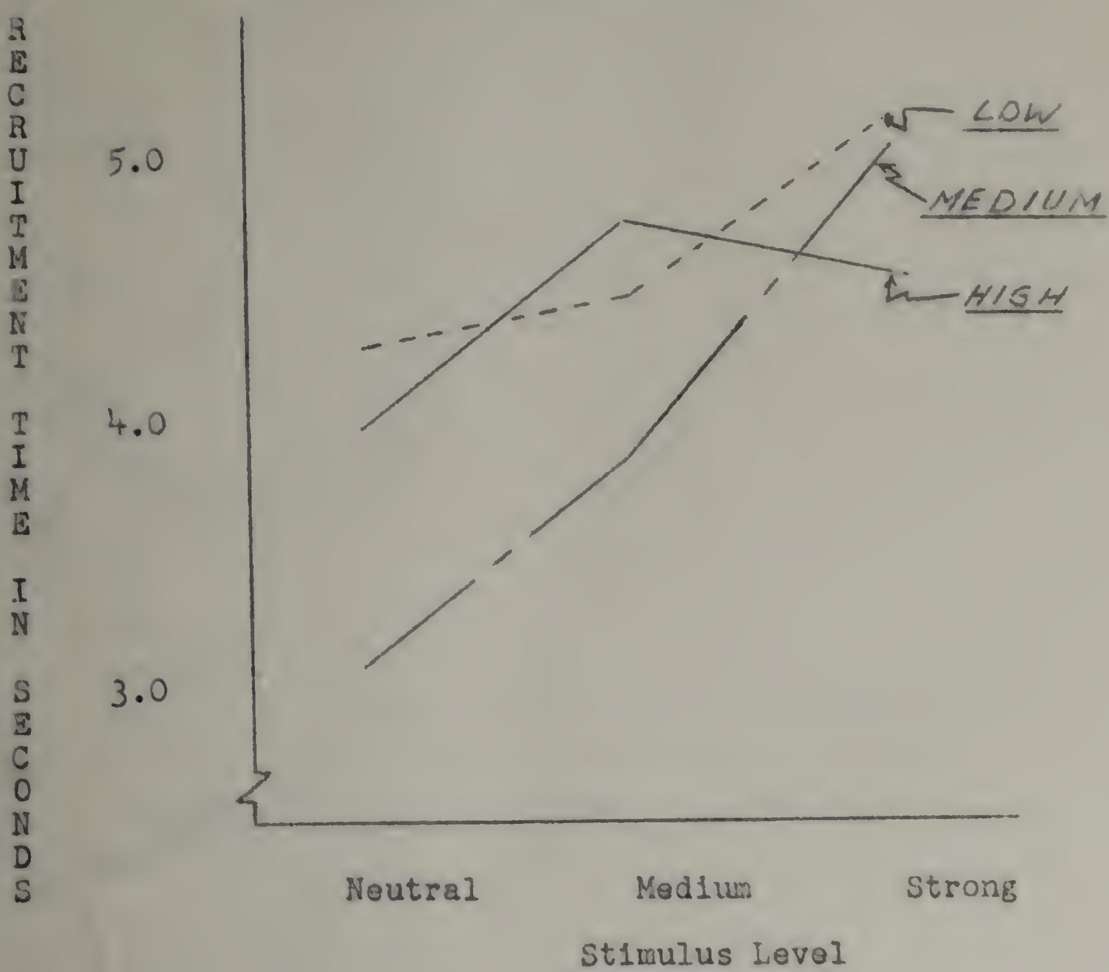


Table 28

Mean Anticipatory Motor Response Time in Seconds of Paranoid Tendencies Groups for Sound Stimuli

Group		
Low	Medium	High
- 0.6	- 0.6	- 0.3

Time for word stimuli. Examination of the means in Table 29 indicates that the schizophrenics high in Social Withdrawal, in contrast to the normal controls and the schizophrenics who were medium and low in social withdrawal, showed an increase in Motoric Response Time from the first to the second half of the test. The increase by the high group occurred even though they had the longest Motoric Response Time to the first test half.

In summary, normal controls and the schizophrenics low and medium in Social Withdrawal respond motorically faster across test halves, while the schizophrenics that scored high in Social Withdrawal showed an increase in their time to respond from first to second test half.

Motoric Withdrawal. Analysis of the GSR conductance measure revealed that the interaction of motoric withdrawal x stimulus level was significant (.05 level) for word stimuli. The means in Table 30 show that the schizophrenics who were medium and high on Motoric Withdrawal increased directly in reactivity along the stimulus level dimension in a manner similar to the normal controls, while the greatest degree of reactivity of the schizophrenics low in Motoric Withdrawal was to the medium level stimuli with less reactivity occurring to both neutral and strong words.

The Motoric Withdrawal groups were significantly different (.05 level) in Respiration Rate Change following

Table 29

Mean Motor Reaction Time in Seconds for the Interaction of Social Withdrawal by Test Half for Word Stimuli

Group	Test Half	
	First	Second
High	3.1	3.5
Medium	1.5	1.1
Low	1.9	1.0

* * *

Table 30

Mean GSR in Micromhos for the Interaction of Motoric Withdrawal by Stimulus Level for Word Stimuli

Group	Stimulus Level		
	Neutral	Medium	Strong
High	0.15	0.20	0.30
Medium	0.33	0.42	0.73
Low	0.13	0.30	0.28

sound stimuli. The means are presented in Table 31. There is a direct relationship between Motoric Withdrawal and a tendency for prestimulus respiration rate to exceed post-stimulus respiration rate, with the group with the highest amount of Motoric Withdrawal reacting most like the normal controls.

In summary, the schizophrenics who were low in Motoric Withdrawal gave a flatter GSR gradient to the stimulus dimension for words, and a smaller poststimulus respiration rate following stimulation by sounds than did the normal controls and the schizophrenics of moderate and high levels of Motoric Withdrawal.

Drug Dosage. Analysis of the GSR in conductance units revealed a significant (.05 level) interaction of drug level x order of presentation for word stimuli. Examination of the means in Table 32 indicates that the schizophrenics lowest in drug dosage were highest in reactivity in the first order of presentation and lowest in reactivity in the second order of presentation. The schizophrenics in the low drug level group showed a sharp reduction, the medium level group showed little change, in a manner similar to the normal controls, and the schizophrenics receiving the highest drug dosages showed an increase in reactivity from the first to the second order of presentation.

Table 31

Mean Respiration Rate Change in Cycles per Minute of Motoric Withdrawal Groups for Sound Stimuli

Group		
Low	Medium	High
0.4	0.2	- 0.2

* * *

Table 32

Mean GSR in Micromhos for the Interaction of Drug Level by Order of Presentation for Word Stimuli

Group	Order of Presentation	
	First	Second
High	0.32	0.48
Medium	0.24	0.26
Low	0.50	0.18

The drug dosage groups are significantly (.01 level) different from each other on Algebraic Total Motor Time for sound stimuli. Inspection of the means in Table 33 reveals that the schizophrenic low drug level group had the greatest Algebraic Total Motor Time disturbance and that the disturbance occurs primarily after complete presentation of the stimulus. The schizophrenic high drug level group had the second longest length of Algebraic Total Motor Time disturbance and the moderately drugged schizophrenics had the least. The schizophrenic drug level groups were also significantly (.01 level) different in Positive Motor Time for sound stimuli. The means are presented in Table 34. It is evident that the low drug level schizophrenics displayed the longest Positive Motor Time disturbance and that the medium drug level schizophrenics had the shortest length of Positive Motor Time disturbance. The schizophrenics in the medium and high drug level groups were more like the normal controls than the low drug level group. Since there was no significant difference among the drug level groups on the Anticipatory Motor Time measure, which was subtracted from the Positive Motor Time measure to obtain the Algebraic Motor Time measure, the significance of the Algebraic Motor Time may be attributed to differences in Positive Motor Time.

In summary, the schizophrenic groups medium and high in drug level were more similar to the normal controls than were

Table 33

Mean Algebraic Total Motor Time in Seconds of Drug Level Groups for Sound Stimuli

Group		
Low	Medium	High
0.9	0	0.4

* * *

Table 34

Mean Positive Motor Time in Seconds of Drug Level Groups for Sound Stimuli

Group		
Low	Medium	High
1.4	0.6	1.0

the schizophrenics low in drug level. The low drug level group differed from the normal controls in having had a marked reduction, rather than little change, in their level of GSR reactivity from the first to the second test half for word stimuli, and in their having had a longer length of finger movement disturbance following stimulation by sound stimuli than did the normal controls.

Initial Basal Conductance Level. Analysis of the Initial Basal Conductance data (Table 35) revealed a significant (.001 level) difference between the Initial Basal Conductance Level groups. The significant finding and the means in Table 36 reflect the selection procedure of the Initial Basal Conductance Level groups in that schizophrenics with low Initial Basal Conductance were placed in the low level group, those with medium conductance in the medium group, and the schizophrenics with high Initial Basal Conductance in the high level group.

Analysis of the GSR to sound stimuli revealed a significant (.05 level) difference among the schizophrenics divided according to initial basal conductance level for sound stimuli. Inspection of the means in Table 37 reveals that schizophrenics low in initial basal conductance gave the smallest GSRs and schizophrenics high in initial basal conductance the largest GSRs. The interaction of initial basal conductance level x stimulus level for the

Table 35

Initial Basal Conductance in Micromhos Analysis
for Initial Basal Conductance Level Groups

Source of Variance	ss	df	MS	F
Between Groups	171.8	2	85.9	21.5***
Within Groups	84.0	21	4.0	
Total	255.8	23		

*** .001 level of significance

Table 36

Mean Initial Basal Conductance in Micromhos of Initial Basal Conductance Level Groups

Group		
Low	Medium	High
3.57	5.64	9.98

* * *

Table 37

Mean GSR in Micromhos of Initial Basal Conductance Level Groups for Sound Stimuli

Group		
Low	Medium	High
0.10	0.43	0.75

GSR is significant (.01 level) for sound stimuli. The means in Table 38 and Figure 7 show that schizophrenics low in initial basal conductance were almost nonreactive to the stimulus dimension, while schizophrenics medium in initial basal conductance were moderately reactive and schizophrenics high in initial basal conductance level were markedly reactive as a function of the stimulus dimension. The large GSRs and greater reactivity across the stimulus dimension of the schizophrenics high in initial basal conductance level were similar to those of the normal controls.

Analysis of GSR Recruitment Time revealed a significant (.05 level) difference in recovery time following stimulation by word stimuli for the schizophrenics divided according to initial basal conductance level. The means in Table 39 indicate that the schizophrenics low in initial basal conductance level had the longest GSR Recruitment Time mean, the medium group a shorter Recruitment Time mean, and the schizophrenics high in initial basal conductance level the shortest GSR Recruitment Time mean. The groups medium and high in initial basal conductance level were similar to the normal controls in their short recruitment times. The interaction of initial basal conductance x stimulus level for this measure was also significant (.001 level) for word stimuli. Table 40 and Figure 8 present the means for the interaction. The schizophrenics low in initial basal conductance level

Table 38

Mean GSR in Micromhos for the Interaction of Initial Basal Conductance Level by Stimulus Level for Sound Stimuli

Group	Stimulus Level		
	Neutral	Medium	Strong
High	0.22	0.48	1.55
Medium	0.04	0.30	0.96
Low	0	0.01	0.27

Figure 7

Mean GSR in Micromhos for the Interaction of Initial Basal Conductance Level by Stimulus Level for Sound Stimuli

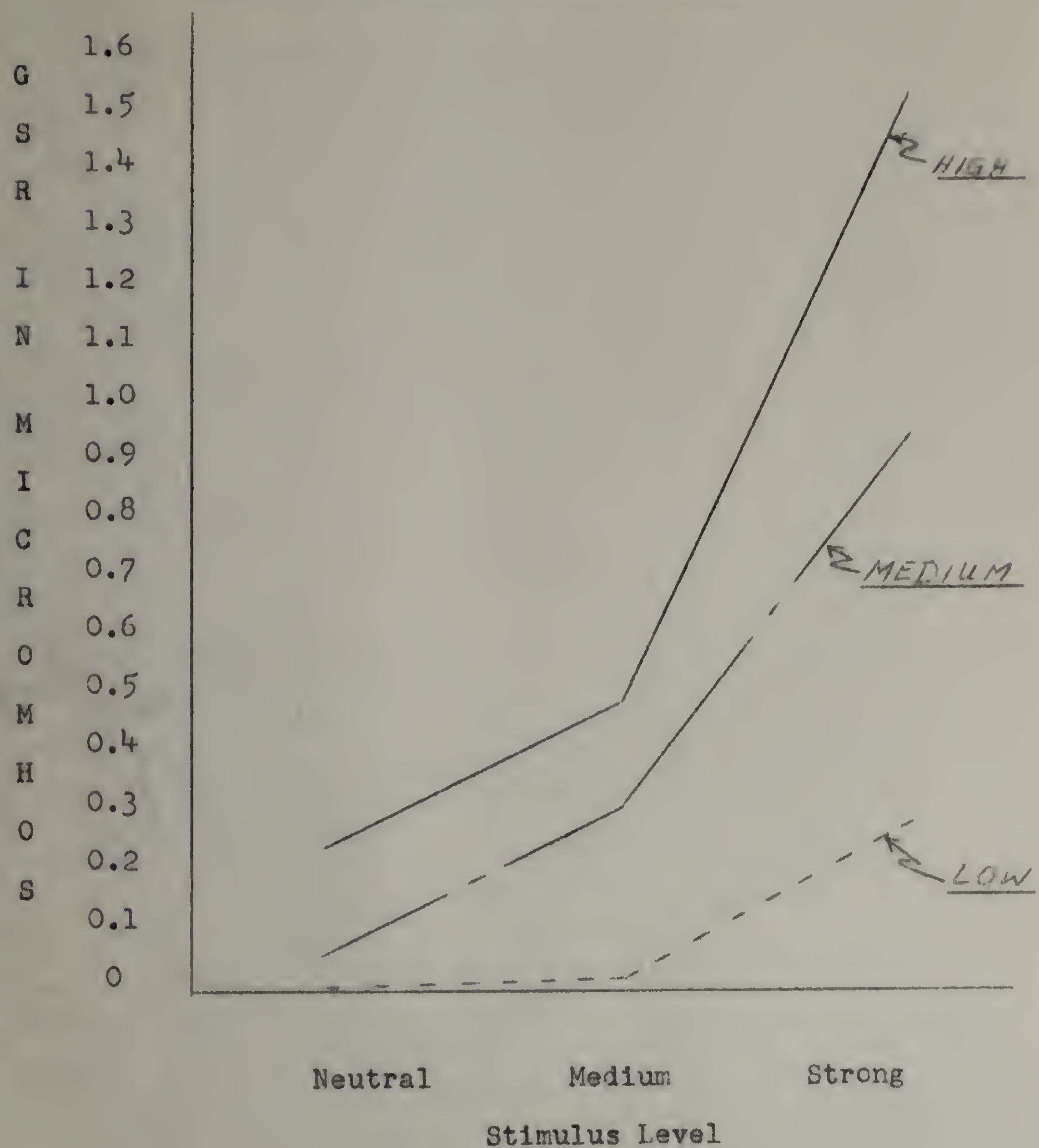


Table 39

GSR Mean Recruitment Time in Seconds of Initial Basal Conductance Level Groups for Word Stimuli

Group		
Low	Medium	High
5.7	3.9	3.4

* * *

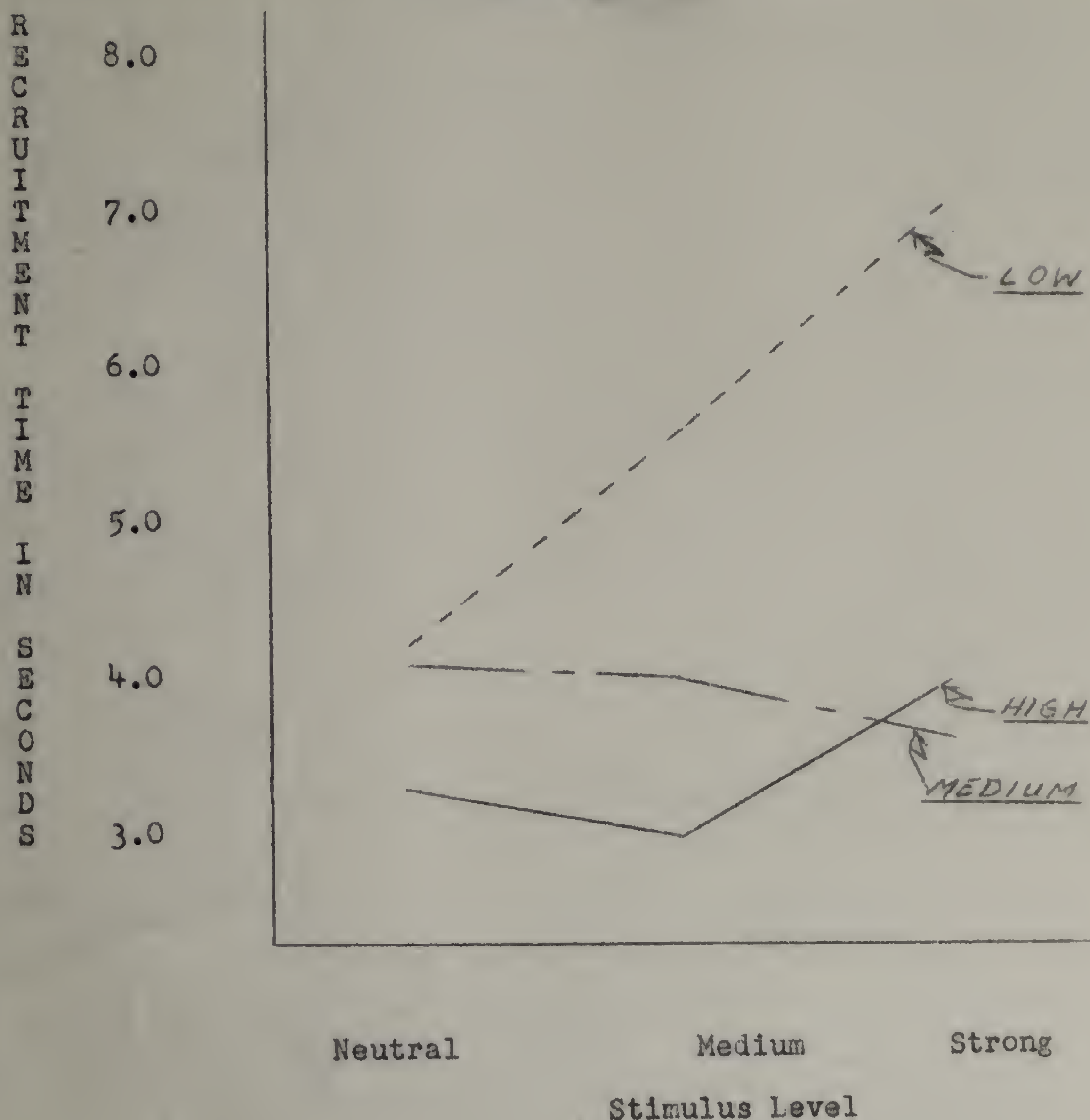
Table 40

GSR Mean Recruitment Time in Seconds for the Interaction of Initial Basal Conductance Level by Stimulus Level for Word Stimuli

Group	Stimulus Level		
	Neutral	Medium	Strong
High	3.3	3.0	4.0
Medium	4.1	4.0	3.6
Low	4.2	5.6	7.2

Figure 8

GSR Mean Recruitment Time in Seconds for the Interaction of Initial Basal Conductance Level by Stimulus Level for Word Stimuli



reacted in a manner similar to normal controls in that they increased directly in GSR Recruitment Time as a function of the stimulus dimension. In contrast, the schizophrenics medium and high in initial basal conductance level decreased in GSR Recruitment Time from the neutral to the medium level stimuli, but to the strong stimuli the schizophrenics medium in initial basal conductance level showed a further decline in Recruitment Time, while the schizophrenics high in initial basal conductance level increased in GSR Recruitment Time from the medium to the strong stimuli.

Analysis of the conductance Basal Level measure revealed significant (.001 level) differences among the initial basal conductance level groups to both word and sound stimuli. Basal Level means in micromhos for the groups are presented in Table 41 for word stimuli and Table 42 for sound stimuli. In both cases, the schizophrenics low in initial basal conductance level had the smallest Basal Level mean, the schizophrenics medium in initial basal conductance level the moderate Basal Level mean, and the schizophrenics high in initial basal conductance level the highest Basal Level mean. The Basal Level means of the group high in initial basal conductance level were similar to the Basal Level means of the normal controls. The interaction of initial basal conductance level x order of presentation is significant (.05 level) for sound stimuli for the Basal Level

Table 41

Mean Basal Level in Micromhos of Initial Basal Conductance Level Groups for Word Stimuli

Group		
Low	Medium	High
3.48	5.70	9.70

* * *

Table 42

Mean Basal Level in Micromhos of Initial Basal Conductance Level Groups for Sound Stimuli

Group		
Low	Medium	High
3.08	5.58	9.37

measure. As can be seen from the means in Table 43, the schizophrenics with low initial basal conductance levels had the smaller Basal Level means for both orders of presentation. The schizophrenics with high initial basal conductance level had the largest Basal Level means for both orders of presentation. Additionally, as initial conductance level increased, the decrease in Basal Level from the first to the second order of presentation also increased. None of the schizophrenic groups reacted like the normal controls whose Basal Level mean increased from the first to the second order of presentation for sound stimuli.

Analysis of Anticipatory Motor Response Time revealed a significant (.05 level) interaction of initial basal conductance level x stimulus level for word stimuli. Inspection of Table 44 and Figure 9 shows that the schizophrenic group with the low initial basal conductance level had a gradient to the stimulus dimension that indicated a direct increase in the length of Anticipatory Motor Response Time as stimuli increased in strength. The schizophrenics medium and high in initial basal conductance level were similar in showing gradients to the stimulus dimension that were flatter than the gradient of the group that was low in initial basal conductance level. Although the flatness of the gradient of the group medium in initial basal conductance level was similar to that of the normal controls, the normal

Table 43

Mean Basal Level in Micromhos for the Interaction of Initial Basal Conductance Level by Order of Presentation for Sound Stimuli

Group	Order of Presentation	
	First	Second
High	12.24	6.51
Medium	6.72	4.43
Low	3.56	2.61

* * *

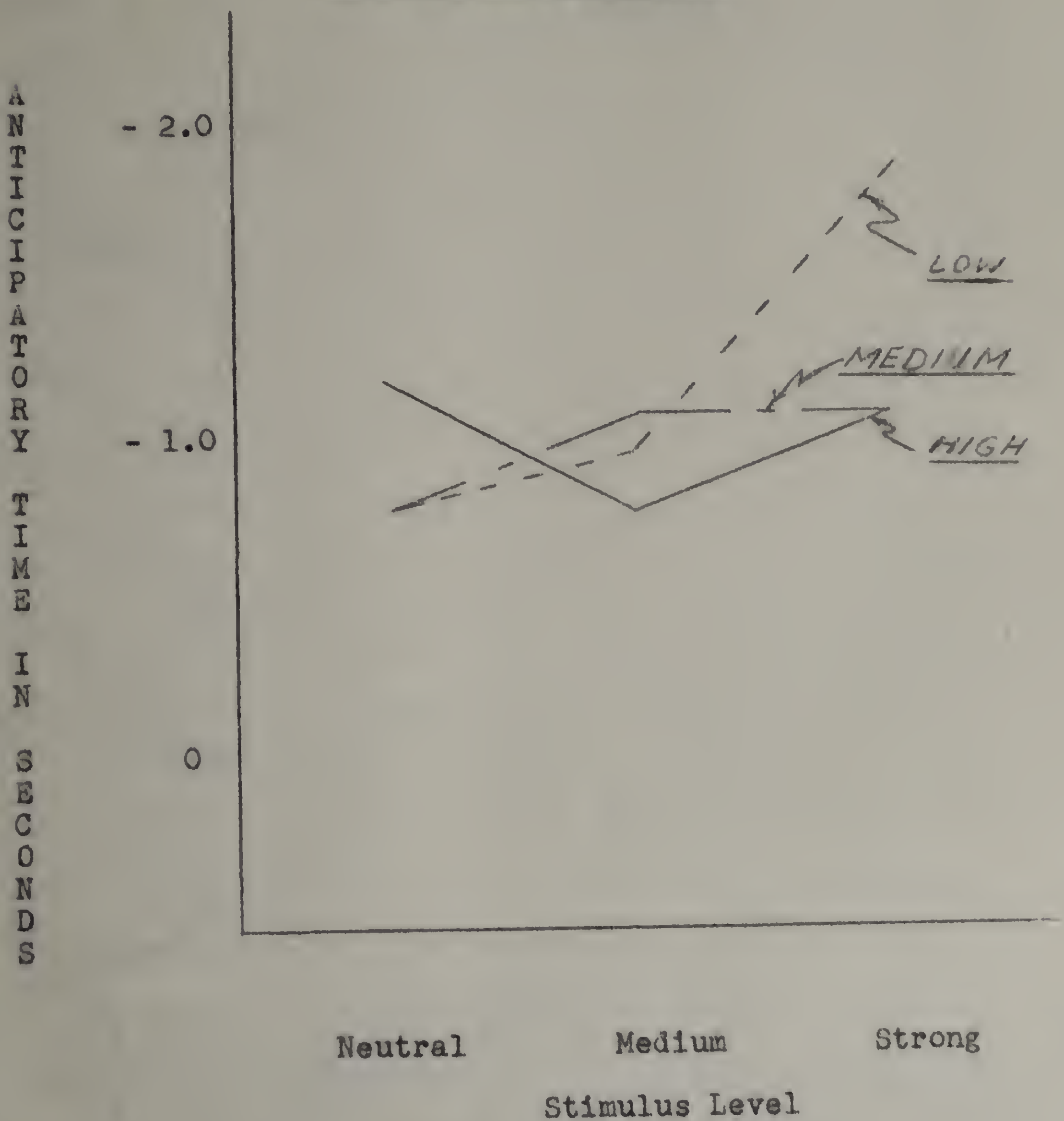
Table 44

Mean Anticipatory Motor Response Time in Seconds for the Interaction of Initial Basal Conductance Level by Stimulus Level for Word Stimuli

Group	Stimulus Level		
	Neutral	Medium	Strong
High	- 1.2	- 0.8	- 1.1
Medium	- 0.8	- 1.1	- 1.1
Low	- 0.8	- 1.0	- 1.9

Figure 9

Mean Anticipatory Motor Response Time in Seconds for the Interaction of Initial Basal Conductance Level by Stimulus Level for Word Stimuli



controls did not vary between neutral and medium stimuli, and they had a small increase occur to the strong stimuli.

Analysis of Total Motor Response Time revealed that the interaction of initial basal conductance level x stimulus level was significant (.05 level) for word stimuli. The means in Table 45 show a large increase in Total Motor Response Time between the medium and strong stimuli for the schizophrenics low in initial basal conductance level. Since the Positive Motor Response Time measure was not significant, and since this measure was dependent on the sum of that measure and Anticipatory Motor Response Time, the present finding can be seen as reflecting the previously discussed significant Anticipatory Motor Response Time finding.

The interaction of initial basal conductance level x order of presentation for Respiration Rate Change was significant (.05 level) for sound stimuli. The means in Table 46 indicate that the difference between the poststimulus minus the prestimulus respiration rates of the groups low and high in initial basal conductance became more positive when sound stimuli followed word stimuli than when sound stimuli preceded word stimuli in a manner similar to the normal controls. In contrast, the schizophrenics medium in initial basal conductance level showed a reverse reaction in that the difference between their poststimulus minus their prestimulus respiration rates was positive when sound

Table 45

Mean Total Motor Response Time in Seconds for the Interaction of Initial Basal Conductance Level by Stimulus Level for Word Stimuli

Group	Stimulus Level		
	Neutral	Medium	Strong
High	2.0	1.9	1.9
Medium	1.8	1.9	2.0
Low	1.8	1.9	3.0

* * *

Table 46

Mean Respiration Rate Change in Cycles per Minute for the Interaction of Initial Basal Conductance Level by Order of Presentation for Sound Stimuli

Group	Order of Presentation	
	First	Second
High	0.3	0.6
Medium	0.5	- 0.1
Low	- 0.6	0.2

stimuli preceded word stimuli, but became negative when sound stimuli followed word stimuli.

In summary, the greater reactivity to stimulation, the higher arousal level, the greater variance in reactivity as a function of variations in stimulus strength, and the faster rate of recovery after stimulation result in the schizophrenic group high in initial basal level being more similar to the normal controls than the other initial basal level groups. In contrast, the schizophrenic group low in initial basal level was less reactive to stimulation, had a lower arousal level, showed less variance in reactivity as a function of variance in stimulus strength, and had a slower rate of recovery after stimulation than did the schizophrenic groups medium and high in initial basal level and the normal controls.

DISCUSSION

The finding that acute and chronic schizophrenics, as determined by length of hospitalization, do not differ significantly in general level of physiological arousal fails to support the prediction based on Venables' (1964a) suggestion that acute schizophrenics are lower in arousal than chronic schizophrenics. The finding also fails to support Mednick's (1958) suggestion that acute schizophrenics are in a higher state of arousal than chronic schizophrenics. Also, the prediction, based on Venables' (1964a) suggestion that schizophrenics differ in arousal level as a function of degree of social withdrawal, was not supported by the findings of this study. Not only do the theories of Mednick (1958) and Venables (1964a) differ in their conclusions concerning general levels of arousal in acute and chronic schizophrenics, but there is a lack of consistency in the research findings on general levels of arousal in acute and chronic schizophrenics (Duffy, 1962; Lang and Buss, 1965; Mednick, 1958; Shakow, 1963; and Venables, 1964b).

The finding in the present study of significant differences in arousal level among GPM schizophrenics, PPM schizophrenics, and normal controls, with the GPM group the least aroused and the normal controls the most aroused, suggests that premorbid adjustment may be a more crucial variable than chronicity in differentiating between subgroups of schizophrenics. That is, it is possible to support Venables' suggestion that some schizophrenics are less aroused than others if we substitute GPM schizophrenics for acutely disturbed schizophrenics. Two important points must, however, be considered. First, as Higgins and Peterson (1966) suggest, premorbidity and chronicity probably should be treated separately. Second, it should be noted that the present study was designed primarily to evaluate premorbid classification, and not chronicity or social withdrawal. Also, the schizophrenics in this study were not in a state of manifest acute excitability. A necessary requirement for participation in the research was that the schizophrenic patient be able to understand and respond to word stimuli. This requirement automatically precluded a number of acutely disturbed patients from being used as subjects. The generally low level of arousal of the schizophrenics suggests that, although they may have once been excitable, they had attained a reasonable degree of stability by the time of testing. It should be noted, however, that Venables (1964a) classifies subjects into acutes and chronics according to length of hospitalization, as was done in the present study.

The prediction, based on Venables' (1964a) suggestion that chronic schizophrenics would be less reactive to stimulation than acute schizophrenics, was not upheld by the findings of this study. Both the acute and the chronic schizophrenics were similar in their low level of autonomic reactivity to stimulation. This was found for both the GSR, a measure of immediate reactivity to stimulation, and for post-stimulus change in basal level during the thirty-second interstimulus interval, a measure of more long term autonomic reactivity to stimulation.

The prediction that the chronic schizophrenics would be less reactive than acute schizophrenics was not upheld with acquired intensity values as well as with primary intensity values. Regardless of chronicity or premorbid classification, schizophrenic subjects tended to be less reactive to stimuli with acquired intensity value than to stimuli with primary intensity value. This supports the findings of Paintal (1951) and of Sologub (1960). Thus, the schizophrenic seems better able to insulate himself from stimuli that are arousing because of their acquired meaning than from stimuli that are arousing because of their primary intensity value. Nevertheless, the responses of the schizophrenics to primary stimuli were lower than the responses of normals.

The reduced reactivity to stimulation of schizophrenics in comparison to control subjects found in this study is one of the more consistent findings that have been reported with regard to schizophrenics (Lang and Buss, 1965; Lynn, 1963). The results can not readily be attributed to the medications they were receiving. First, both Lynn (1963), in a review of the Russian literature, and Venables (1964b) have indicated that autonomic system responses of schizophrenics receiving tranquilizers are similar to autonomic responses of control subjects. In this study the schizophrenics and normal controls were found to differ significantly in their autonomic responses. Second, the lack of significant differences among schizophrenics receiving different drug dosages indicates that their medications were not solely responsible for how they were functioning during the experiment. Third, the finding that the reduced responsiveness of schizophrenics was greater to stimuli of acquired than to stimuli of primary intensity value suggests psychologically mediated insulation from stimulation, rather than a physically inadequate response system. Also, Paintal's (1951) study, which reported similar findings, was carried out before drugs were widely used in treating schizophrenics. It would appear, then, that the schizophrenics in this study had attained a stable level of reduced functioning by avoiding attending to the meaningful elements in cues which have socioemotional significance.

Venables' (1964a) suggestion that acute schizophrenics are overreactive to stimulation as a result of their low resting level of arousal and that chronic schizophrenics are underreactive to stimulation as a result of their high resting level of arousal was not supported. That is, when scores on Initial Basal Conductance, a measure of pretest arousal level, were used to divide schizophrenics into low, medium, and high arousal level groups, reactivity to stimulation was found to vary directly in strength with Initial Basal Conductance, rather than inversely as Venables (1964a) suggested. A possible explanation for the finding of a direct rather than inverse relationship between reactivity to stimulation and arousal level is that the schizophrenics tested were not at such a high level of arousal as to have their reactivity to stimulation subjected to the "law of initial value" (Wilder, 1958), or to a curvilinear relationship between level of arousal and reactivity.

The prediction, based on Epstein's (in press) suggestion, that the schizophrenics would fail to follow the stimulus intensity dimension as closely as normals was supported. That is, although the responses of the schizophrenics varied as a function of the stimulus dimension, the magnitude of their responses, regardless of premorbid classification, did not vary as strongly with the intensity of either type of stimulus as did the responses of the normal controls. Examination of individual gradients within the three groups further supports this finding in that the magnitude of the responses of thirteen of the fourteen normal control subjects directly followed the levels within the stimulus dimension for both types of stimuli, while the magnitude of the responses of only eight of the fourteen GPM schizophrenics directly followed the word stimulus dimension, and the magnitude of the responses of ten of the fourteen GPM schizophrenics directly followed the sound stimulus dimension. In the PPM schizophrenic group, the magnitude of the responses of only six subjects followed directly the word stimulus dimension, and the magnitude of the responses of only nine of fourteen PPM schizophrenics directly followed the sound stimulus dimension. The schizophrenics were generally underresponsive, suggesting overcontrol rather than adequate response to excitation.

It is noteworthy that the GPM and PPM schizophrenic subjects were found to be homogeneous in their uniformly low level of reactivity to stimulation in comparison to each other and in comparison to normal controls on measures reflecting smooth muscle activity, i.e., GSR and Basal Level measures, but that on measures reflecting striped muscle activity, i.e., Verbal Reaction Time, Respiration Rate Change, and Poststimulus Respiration Rate, the GPM and PPM schizophrenic subjects showed significantly greater variability in comparison to each other and in comparison to normal control subjects. When the variances of the subjects were either homogeneous or heterogeneous, the finding held for both between and within the subgroupings of subjects.

The significantly greater amount of variance of the PPM schizophrenic subjects in comparison to the GPM and normal control subjects, who also occasionally differed significantly from each other in variance on measures reflecting striped muscle activity, may account for the scarcity of significant findings among the means of the diagnostic groups on measures that reflect striped muscle activity.

In general, one group of schizophrenics, the GPMs, were found to be uniformly underreactive on different measures of their functioning. A second group of schizophrenics, PPMs, were found to be uniformly underreactive to measures reflecting smooth muscle activity, but more reactive and highly variable on measures reflecting striped muscle activity. Finally, on some measures both groups of schizophrenics responded like normal controls, and on other measures they differed significantly from normal controls. The pronounced differences in level and variability of schizophrenic functioning, both within subgroups of schizophrenics and in comparison to normal controls, supports Epstein's theory that a basic characteristic of schizophrenic functioning is a lack of adequate inhibitory control of excitation. The lack of adequate control of excitation is seen in the consistent overcontrol by GPM and PPM schizophrenics in comparison to each other and to normal controls in one response system, and the inconsistent responsiveness of PPM schizophrenics in a second response system in comparison to GPM schizophrenics and normal controls.

SUMMARY

Physiological responses of good premorbid (GPM) and poor premorbid (PPM) schizophrenics, selected on the basis of the Phillips Scale, to dimensions of primary intensity of sound stimuli and of socioemotional significance of words were examined and compared to responses given by normal controls composed of male attendants at the same hospital. The physiological responses of the schizophrenics were also examined as a function of length of hospitalization, paranoid defense system, degree of social withdrawal, degree of motoric withdrawal, drug dosage, and initial basal conductance level.

The major findings were:

(1) A significant difference in resting level of arousal was found between GPM schizophrenics, PPM schizophrenics and normal controls. The GPM schizophrenics were the least aroused group, and the normal controls were the most aroused group. No significant differences were found between schizophrenics subdivided on the basis of chronicity of their illness, nor on the basis of degree of social withdrawal as had been predicted on the basis of Venables' (1964a) suggestions.

(2) The prediction, based on Venables' (1964a) suggestion that chronic schizophrenics would be less reactive than acute schizophrenics, was not upheld. Regardless of chronicity or premorbid classification, schizophrenics were uniformly physiologically unresponsive to stimulation in comparison to normal controls.

(3) Regardless of chronicity or premorbid classification, schizophrenics were less responsive to stimuli with acquired intensity value than to stimuli of primary intensity value. This supported previous findings by Paintal (1951) and Sologub (1960). It was suggested that this indicates a psychologically mediated insulation from stimulation, rather than a physically inadequate response system.

(4) Reactivity to stimulation of schizophrenics was found to vary directly in strength with initial arousal level, rather than inversely as suggested by Venables (1964a). It was suggested that the schizophrenics may not have been so highly aroused as to have their reactivity to stimulation sub-

jected to an inverse relationship between level of arousal and reactivity.

(5) The prediction, based on Epstein's suggestion that the magnitude of the response of schizophrenics would not follow stimulus intensity dimensions as directly as the magnitude of the responses of normal controls, was upheld. The lack of correspondence between magnitude of response and stimulus intensity dimension was greater to word stimuli than to sound stimuli in schizophrenics. Overcontrol of excitation seemed to underlie this finding.

(6) Epstein's theory that a basic characteristic of schizophrenic functioning is a lack of adequate inhibitory control of excitation was found to be supported by the consistent overcontrol by GPM and PPM schizophrenics in comparison to each other and to normal controls on measures reflecting smooth muscle activity, and the inconsistent responsiveness of PPM schizophrenics on measures reflecting striped muscle activity in comparison to GPM schizophrenics and normal controls.

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Appendix A

Phillips Scale of Premorbid History

I. PRE-MORBID HISTORY

A. Recent Sexual Adjustment

1.	Stable heterosexual relation and marriage	0
2.	Continued heterosexual relation and marriage but unable to extablish home	1
3.	Continued heterosexual relation and marriage broken by permanent separation	2
4. (a)	Continued heterosexual relation and marriage but with low sexual drive	3
(b)	Continued heterosexual relation with deep emotional meaning but emotionally unable to develop it into marriage	3
5. (a)	Casual but continued heterosexual relations, i.e., "affairs", but nothing more	4
(b)	Homosexual contacts with lack of or chronic failure in heterosexual experiences	4
6. (a)	Occasional casual heterosexual or homosexual experience with no deep emotional bond	5
(b)	Solitary masturbation with no active attempt at homosexual or heterosexual experience	5
7.	No sexual interest in either men or women	6

B. Social Aspects of Sexual Life During Adolescence and Immediately Beyond

1.	Always showed a healthy interest in (girls)(boys) with a steady (girl) (boy) friend during adolescence	0
2.	Started taking (girls) (boys) out regularly in adolescence	1
3.	Always mixed closely with boys and girls	2
4.	Consistent deep interest in (male) (female) attachments with restricted or no interest in (girls) (boys)	3
5. (a)	Casual female male attachments with inadequate attempts at adjustment to going out with girls (boys)	4
(b)	Casual contacts with boys and girls	4
6. (a)	Casual contacts with boys (girls), lack of interest in girls (boys)	5
(b)	Occasional contacts with girls (boys)	5
7.	No desire to be with boys and girls; never went out with girls (boys)	6

C. Social Aspects of Recent Sexual Life: 30 Years of Age and Above

1.	Married and has children, living as a family unit	0
2.	Married and has children but unable to establish or maintain a family home	1
3.	Has been married and had children but permanently separated	2
4. (a)	Married but considerable marital discord	3
(b)	Single, but has had engagement or deep heterosexual relationship but emotionally unable to carry it through to marriage	3
5.	Single, with short engagements or relationships with women which do not appear to have had much emotional depth for both partners, i.e., "affairs"	4

6. (a) Single, has gone out with a few (girls) (boys) but without other indications of a continuous interest in (women) (men) 5
   (b) Single, consistent deep interest in (male) (female) attachments, no interest in (men) (women) 5
7. (a) Single, occasional (male) (female) contacts, no interest in (men) (women) 6
   (b) Single, interested in neither men nor women 6

D. Social Aspects of Recent Sexual Life: Below 30 years of Age

1. Married living as family unit, with or without children 0
2. (a) Married, with or without children, but unable to establish or maintain a family home 1
   (b) Single but engaged or in a deep heterosexual relationship (presumably leading toward marriage) 1
3. Single, has had engagement or deep heterosexual relationship but has emotionally been unable to carry it through to marriage 2
4. Single, consistent deep interest in (male) (female) attachments, with restricted or lack of interest in (men) (women) 3
5. Single, casual (male) (female) relationships with restricted or lack of interest in (men) (women) 4
6. Single, has gone out with a few (boys) (girls) casually but without other indications of a continuous interest in (men) (women) 5
7. (a) Single, never interest in or never associated with either men or women 6
   (b) Antisocial 6

E. Personal Relations: History

1. Always has had a number of close friends but did not habitually play a leading role 1
2. From adolescence on had a few close friends 3
3. From adolescence on had a few casual friends 3
4. From adolescence on stopped having friends 4
5. (a) No intimate friends after childhood 5
   (b) Casual but never any deep intimate mutual friendships 5
6. Never worried about boys or girls; no desire to be with boys or girls 6

F. Recent Premorbid Adjustment in Personal Relations

1. Habitually mixed with others, but not a leader 1
2. Mixed only with a close friend or group of friends 3
3. No close friends; very few friends; had friends but never quite accepted by them 4
4. Quiet; aloof; seclusive; preferred to be by self 5
5. Antisocial 6

Appendix B

Venables' Scale for Measuring

Social Withdrawal

1. How much does he move around? Does he sit all day unless pushed to follow routine? Or, is he usually walking around or restlessly moving some part of his body?

1	2	3	4	5
Usually Motionless	Underactive	Moves about as appropriate	Restless	Almost constantly moving

2. Compared to the average person, how taciturn or talkative is he? Judge only the amount of speech; do not consider its relevance nor whether it was spontaneous or elicited by questioning.

1	2	3	4	5
Mute throughout interview	Distinctly less	As talkative as average	Distinctly more	Conspicuously overtalkative

3. Does he usually give the appearance of being tired and worn out or lively and energetic as compared to others?

1	2	3	4	5
Almost completely worn out	Tired	As lively as most	Livelier and more energetic	Overactive and abnormally energetic

4. Does he have friends in the ward?

1	2	3	4	5
None at all	Acknowledges one or two other patients	Has one or two fairly regular friends	Is normally friendly	Makes friends with as many people as he can

5. Compared to others, how loud or intense is his speech? Is it barely audible or is it loud and (or) intense?

1	2	3	4	5
Almost inaudible	Distinctly less audible or less intense	As loud as average	Distinctly louder or more intense	Shouts or yells

6. How much interest does he show in the things going on around him? Which of the following does he do: (a) listen to the radio or watch television; (b) play games; (c) read newspapers or magazines; (d) go to dances or socials; (e) talk about ward happenings, sport or news events; (f) write letters; (g) go to parties?

1	2	3	4	5
Interested in nothing, just sits	Any one	Any two or three	Any 4 or 5	All 6 or more

7. How often does he speak to others? Does he ask for things, say hello, ask questions, make comments, or otherwise start a back-and-forth conversation?

1	2	3	4	5
Never	Occasionally	Less often than the ordinary person	As often as the ordinary person	Nearly always speaking to someone

8. Compared with others are his reactions (walking, talking, gestures) slower and more deliberate, or, do they appear faster or hurried?

1	2	3	4	5
Markedly slower	A little slower	As fast as average	A little faster	Conspicuously faster or hurried

9. Does he stay by himself and avoid others, or does he like being with people?

1	2	3	4	5
Always stays by himself. Ignores everyone	Usually by himself. Mixes sometimes	About as much alone as with others	Usually in company with others	Always in company with others

10. Typically how much does he talk if spoken to?

1	2	3	4	5
Does not answer	Only 3 or 4 words	Less than the ordinary person	As much as the ordinary person	Hard to stop

Appendix C

Venables and O'Connor's Scale for Measuring Paranoid Schizophrenia

1. Does he typically keep himself clean or must he be reminded to wash or be washed? Does he keep himself neat and his hair combed, or, are his clothes unbuttoned, disarranged, or soiled with food, dirt or fæces?

1	2	3	4	5
Neater and cleaner than most	As neat and clean as most	Below average cleanliness and neatness	Distinctly sloppy and dirty	Requires special handling. Wets or soils self

2. Does he tend to suspect or believe on slight evidence or without good reason that people and external forces are trying to or now do influence his behavior and control his thinking?

1	2	3	4	5
No unjustified suspicions	Will admit suspicion when pressed	Easily admits suspicion	Openly states others are trying to control him	Has firm conviction that he is influenced or controlled

3. How incongruous are his emotional responses? E.G., giggling or crying for no apparent reason or not showing any emotion when emotion would be appropriately shown?

1	2	3	4	5
As normal	Slightly different from normal	Responses somewhat incongruous	Distinctly incongruous	Very markedly incongruous

4. Does he tend to suspect or to believe on slight evidence or without good reason that some people talk about, refer to, or watch him?

1	2	3	4	5
No unjustified suspicions	Will admit suspicion	Easily admits suspicion	Opnely states that he is watched	Has firm conviction of being watched

5. How well oriented is he as to where he is? Does he know (a) that he is in a hospital; (b) where the hospital is; (c) the name of the hospital?

1	2	3	4	5
As normal	Sometimes makes errors	Slight confusion	Very muddled	Completely confused

6. Does he tend to suspect or to believe on slight evidence or without good reason that some people are against him (persecuting, conspiring, cheating, depriving, punishing in various ways?

1	2	3	4	5
No unjustified suspicions expressed	When pressed expresses belief that he is conspired against	Frequently inclined to suspect	Frank inclination to believe in persecution	Strongly expressed conviction of persecution

7. Does he assume or maintain peculiar, unnatural or bizarre postures?

1	2	3	4	5
None	On rare occasions	For short periods	Frequently	All the time

8. Does he have an exaggeratedly high opinion of himself or an unjustified belief or conviction of having unusual ability, knowledge power, wealth. or status?

1	2	3	4	5
No expressed high opinion of himself	When pressed expresses a high opinion of himself	Frequently expresses a high opinion of himself	Open conviction of unusual power, wealth, etc.	Strongly expressed conviction of grandiose or fantastic power,wealth, etc.

9. How well oriented is he as to time? For instance, does he know (a) the season; (b) the month; (c) the calendar year; (d) the day of the week; (e) how long he has been in the hospital?

1	2	3	4	5
As normal	Occasional confusion	Slight confusion	Frequent confusion	Marked continuous confusion

10. Compared to others, how openly hostile is he? Does he show little hostility or a high degree of ill will, resentment, bitterness or hate?

1	2	3	4	5
No open hostility	Relatively little hostility	Some hostility	Rather hostile	Very hostile

Appendix D

Analysis of Variance Tables for all Measures
Examined Comparing Good Premorbids,
Poor Premorbids, and Normal Controls

Premorbidity-H&R - Words

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		5549810400.0000	1	5549810400.0000
2	G	9.29***	1526590493.9063	2	763295246.9531
3	O	—	1931125.3968	1	1931125.3968
4	H	13.98***	153086006.9219	1	153086006.9219
5	L	45.44***	647710679.6406	2	323855339.8203
6	GO	—	86057500.0098	2	43028750.0049
7	GH	—	8584518.6406	2	4292259.3203
8	OH	—	5828289.5859	1	5828289.5859
9	GL	10.03***	286053923.7344	4	71513480.9336
10	OL	—	16427462.7188	2	8213731.3594
11	HL	7.91***	79769829.4844	2	39884914.7422
12	S(GO)	—	2957197409.1250	36	82144372.4746
13	GOH	—	2549931.5371	2	1274965.7686
14	GOL	—	21066842.2578	4	5266710.5645
15	GHL	—	43434658.8125	4	10858664.7031
16	OHL	—	12863546.1172	2	6431773.0586
17	SH(GO)	—	394208301.5859	36	10950230.5996
18	SL(GO)	—	513076173.1172	72	7126057.9600
19	GOHL	—	20514376.2832	4	5128594.0706
20	SHL(GO)	—	362892580.7813	72	5040174.7330

Premorbidity -H X L- Tonic

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE		SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN	E	10211611497.2500		110211611497.2500
2	G	4.64*	1608903760.0938	2	804451880.0469
3	O	—	203334157.8125	1	203334157.8125
4	H	19.22***	551924561.4219	1	551924561.4219
5	L	59.20***	7391792166.8750	2	3695896083.4375
6	GO	—	257455113.7188	2	128727556.8594
7	GH	—	43579411.7031	2	21789705.8516
8	OH	—	25856666.0313	1	25856666.0313
9	GL	2.78*	696295626.8750	4	174073906.7188
10	OL	—	52523961.0000	2	26261980.5000
11	HL	13.50***	846803827.6250	2	423401913.8125
12	S(GO)	—	6241324927.7500	36	173370136.8820
13	GOH	—	79638920.2500	2	39819460.1250
14	GOL	—	489226029.1563	4	122306507.2891
15	GHL	—	54150775.7813	4	13537693.9453
16	OHL	—	186186905.4688	2	93093452.7344
17	SH(GO)	—	1033616695.5000	36	28711574.8750
18	SL(GO)	—	4494863519.3750	72	62428659.9912
19	GOHL	—	150603020.3438	4	39150755.0859
20	SHL(GO)	—	2258434519.5000	72	31367146.1040

Premorbidity - Rank Order of H.S.P. - Wards

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		30.8700	1	30.8700
2	G	—	0.0000	2	0.0000
3	O	—	0.0000	1	0.0000
4	H	28.19***	0.7557	1	0.7557
5	L	36.15***	1.4679	2	0.7340
6	GO	—	-0.0000	2	-0.0000
7	GH	—	0.0717	2	0.0356
8	OH	—	0.0040	1	0.0040
9	GL	5.86***	0.4762	4	0.1190
10	OL	—	0.0216	2	0.0108
11	HL	—	0.0968	2	0.0484
12	S(GO)	—	-0.0000	36	-0.0000
13	GOH	—	0.0372	2	0.0186
14	GOL	—	0.0800	4	0.0200
15	GHL	—	0.1488	4	0.0372
16	OHL	—	0.0094	2	0.0047
17	SH(GO)	—	0.9648	36	0.0268
18	SL(GO)	—	1.4593	72	0.0203
19	GOHL	—	0.0849	4	0.0212
20	SHL(GO)	—	1.3217	72	0.0184

Premorbidity - Rank Order of SxR - Form

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE		SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN	E	30.8700	1	30.8700
2	G		0.0000	2	0.0000
3	O		0.0000	1	0.0000
4	H	13.92***	0.1381	1	0.1381
5	L	277.01***	4.7091	2	2.3546
6	GO		-0.0000	2	-0.0000
7	GH		0.0048	2	0.0024
8	OH		0.0175	1	0.0175
9	GL		0.0218	4	0.0054
10	OL		0.0002	2	0.0001
11	HL	8.58***	0.1476	2	0.0738
12	S(GO)		-0.0000	36	-0.0000
13	GOH		0.0260	2	0.0130
14	GOL		0.0564	4	0.0141
15	GHL		0.0313	4	0.0078
16	OHL		0.0101	2	0.0050
17	SH(GO)		0.3552	36	0.0099
18	SL(GO)		0.6150	72	0.0085
19	GOHL		0.0399	4	0.0100
20	SHL(GO)		0.6219	72	0.0086

Premorbidity - ~~Maximum~~ Basal Level - Words

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		1428069128224.0000	1	***************
2	G	4.35*	76710813800.0000	2	38355406900.0000
3	O	—	12056995032.2500	1	12056995032.2500
4	H	—	6100889.2858	1	6100889.2858
5	L	12.10**	142086267.4609	2	71043133.7305
6	GO	—	23941974016.0000	2	11970987008.0000
7	GH	—	79560864.7148	2	39780432.3574
8	OH	—	69090485.9648	1	69090485.9648
9	GL	—	37892724.5391	4	9473181.1348
10	OL	—	26611549.7891	2	13305774.8945
11	HL	8.64***	112479602.3867	2	56239801.1934
12	S(GO)	—	317066563576.0000	36	8807404543.7500
13	GOH	—	40436285.8203	2	20218142.9102
14	GOL	—	35597796.1719	4	8899449.0430
15	GHL	—	527421.6094	4	131855.4023
16	OHL	—	7671015.6094	2	3835507.8047
17	SH(GO)	—	3833059730.1875	36	106473881.3945
18	SL(GO)	—	422905115.8281	72	5873682.1643
19	GOHL	—	64100250.3867	4	16025062.5967
20	SHL(GO)	—	468886928.2813	72	6512318.4484

Premorbidity - ~~Maximum~~ Basal Level - Tones

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		1362791802592.0000	1	***************
2	G	3.94*	70138425838.0000	2	35069212919.0000
3	O	7.20*	64119319381.0000	1	64119319381.0000
4	H	—	221072067.0625	1	221072067.0625
5	L	36.70***	1316476959.5313	2	658238479.7656
6	GO	—	14293474486.0000	2	7146737243.0000
7	GH	—	93078488.9375	2	46539244.4688
8	OH	—	115236380.9375	1	115236380.9375
9	GL	—	96928668.4688	4	24232167.1172
10	OL	—	67221705.4688	2	33610852.7344
11	HL	9.00***	200682205.5625	2	100341102.7813
12	S(GO)	—	320776179208.0000	36	8910449422.5000
13	GOH	—	57865111.1250	2	28932555.5625
14	GOL	—	18705102.5625	4	4676275.6406
15	GHL	—	38261578.4375	4	9565394.6094
16	OHL	—	17836274.4375	2	8918137.2188
17	SH(GO)	—	1958911600.8750	36	54414211.1348
18	SL(GO)	—	1291193505.4375	72	17933243.1309
19	GOHL	—	46189701.5625	4	11547425.3906
20	SHL(GO)	—	803170765.5625	72	11155149.5217

Basal Level Change

Premorbidity - ~~Highest Accomplishment Based~~ - WO

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		160503282096.0000	1	******************
2	G	—	1768410.5080	2	884205.2540
3	O	—	12587967.0000	1	12587967.0000
4	H	11.16**	19212915.5713	1	19212915.5713
5	L	15.01***	141948074.7930	2	70974037.3965
6	GO	—	2677856.8574	2	1338928.4287
7	GH	—	1758148.2852	2	879074.1426
8	OH	—	1824.1431	1	1824.1431
9	GL	3.19*	60314362.9180	4	15078590.7295
10	OL	—	22449824.0039	2	11224912.0020
11	HL	5.83**	50497382.0938	2	25248691.0469
12	S(GO)	—	142961772.9453	36	3971160.3596
13	GOH	—	1667199.7144	2	833599.8572
14	GOL	—	23439736.5684	4	5859934.1421
15	GHL	—	73918572.7656	4	18479643.1914
16	OHL	—	8654804.9512	2	4327402.4756
17	SH(GO)	—	61964186.3008	36	1721227.3972
18	SL(GO)	—	340466443.0391	72	4728700.5973
19	GOHL	—	9740095.6172	4	2435023.9043
20	SHL(GO)	—	311887812.3672	72	4331775.1718

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FORM 1413

Premorbidity - ~~Highest Postestimates Onset~~ Basal Level Change - Tone

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		173614351248.0000	1	*****************
2	G	—	55411276.9834	2	27705638.4917
3	O	—	10920839.6626	1	10920839.6626
4	H	24.13***	295186934.9219	1	295186934.9219
5	L	48.56***	1557405057.9063	2	778702528.9531
6	GO	—	82509762.6953	2	41254881.3477
7	GH	—	36994791.2656	2	18497395.6328
8	OH	5.20*	63561244.4453	1	63561244.4453
9	GL	—	112159992.1250	4	28039998.0313
10	OL	—	41116338.9063	2	20558169.4531
11	HL	14.81***	341182291.2188	2	170591145.6094
12	S(GO)	—	706700876.1406	36	19630579.8920
13	GOH	—	10779610.3203	2	5389805.1602
14	GOL	—	49018772.9609	4	12254693.2402
15	GHL	—	53663096.8594	4	13415774.2148
16	OHL	—	32800134.1484	2	16400067.0742
17	SH(GO)	—	440484085.6797	36	12235669.0466
18	SL(GO)	—	1154594538.0938	72	16036035.2512
19	GOHL	—	90443010.9141	4	22610752.7285
20	SHL(GO)	—	829186900.4844	72	11516484.7290

FORM 1413 PRINTED IN U.S.A.

Premorbidity - GSR Recruitment Time - Words

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		4187.8781	1	4187.8781
2	G	—	61.7918	2	30.8959
3	O	—	7.9218	1	7.9218
4	H	4.43*	12.0214	1	12.0214
5	L	13.05***	74.4182	2	37.2091
6	GO	—	4.2478	2	2.1239
7	GH	—	0.0340	2	0.0170
8	OH	—	2.7783	1	2.7783
9	GL	—	18.7500	4	4.6875
10	OL	—	5.0677	2	2.5339
11	HL	—	7.2467	2	3.6234
12	S(GO)	—	513.7508	36	14.2709
13	GOH	—	7.8031	2	3.9015
14	GOL	—	1.1311	4	0.2828
15	GHL	—	7.9171	4	1.9793
16	OHL	—	0.1659	2	0.0829
17	SH(GO)	—	97.6509	36	2.7125
18	SL(GO)	—	205.1865	72	2.8498
19	GOHL	—	4.0349	4	1.0087
20	SHL(GO)	—	131.8374	72	1.8311

Premorbidity - Recruitment - Time - Tones

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	E	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		4357.7670	1	4357.7670
2	G	—	83.5013	2	41.7506
3	O	—	83.2600	1	83.2600
4	H	4.58*	15.0236	1	15.0236
5	L	13.18***	52.2917	2	26.1459
6	GO	—	8.1861	2	4.0931
7	GH	—	2.5506	2	1.2753
8	OH	—	1.4100	1	1.4100
9	GL	—	6.8007	4	1.7002
10	OL	—	0.4779	2	0.2389
11	HL	6.28**	21.4886	2	10.7443
12	S(GO)	—	1120.1780	36	31.1161
13	GOH	4.86*	31.9033	2	15.9517
14	GOL	—	2.6956	4	0.6739
15	GHL	4.66**	31.8671	4	7.9668
16	OHL	3.40*	11.6459	2	5.8230
17	SH(GO)	—	117.9214	36	3.2756
18	SL(GO)	—	142.7790	72	1.9830
19	GOHL	—	8.8259	4	2.2065
20	SHL(GO)	—	123.0155	72	1.7085

Premorbidity - Time to ~~Maximum~~ Basal Level - Words

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		168862.8686	1	168862.8686
2	G	—	60.4820	2	30.2410
3	O	—	26.2289	1	26.2289
4	H	—	42.5089	1	42.5089
5	L	5.51**	157.3453	2	78.6727
6	GO	—	343.5617	2	171.7808
7	GH	—	6.3288	2	3.1644
8	OH	—	9.9604	1	9.9604
9	GL	—	21.9002	4	5.4750
10	OL	—	3.9588	2	1.9794
11	HL	—	21.2602	2	10.6301
12	S(GO)	—	7083.7638	36	196.7712
13	GOH	—	53.4374	2	26.7187
14	GOL	—	63.5195	4	15.8799
15	GHL	—	64.0695	4	16.0174
16	OHL	—	38.3017	2	19.1508
17	SH(GO)	—	710.0629	36	19.7240
18	SL(GO)	—	1027.4362	72	14.2699
19	GOHL	—	71.8010	4	17.9502
20	SHL(GO)	—	1051.7943	72	14.6083

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Premorbidity - Time to ~~maximum~~ Basal Level - Tones

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		178241.2857	1	178241.2857
2	G	—	65.2467	2	32.6233
3	O	—	85.9835	1	85.9835
4	H	—	126.0129	1	126.0129
5	L	15.60***	593.6638	2	296.8319
6	GO	—	235.6613	2	117.8306
7	GH	—	25.3552	2	12.6776
8	OH	—	64.8129	1	64.8129
9	GL	—	79.6538	4	19.9135
10	OL	—	2.4784	2	1.2392
11	HL	—	20.8829	2	10.4414
12	S(GO)	—	4554.8562	36	126.5238
13	GOH	—	47.2200	2	23.6100
14	GOL	—	95.7783	4	23.9446
15	GHL	—	87.3762	4	21.8440
16	OHL	—	24.0257	2	12.0129
17	SH(GO)	—	1647.0057	36	45.7502
18	SL(GO)	—	1370.2124	72	19.0307
19	GOHL	—	117.0571	4	29.2643
20	SHL(GO)	—	1188.4514	72	16.5063

Premorbidity - G.S.R. Latency - Words

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		96682.9206	1	96682.9206
2	G	3.98*	1983.6965	2	991.8483
3	O	—	8.4700	1	8.4700
4	H	6.88*	167.0914	1	167.0914
5	L	9.33***	509.5539	2	254.7769
6	GO	—	33.6867	2	16.8433
7	GH	—	16.3352	2	8.1676
8	OH	—	38.8929	1	38.8929
9	GL	—	128.9675	4	32.2419
10	OL	—	67.5117	2	33.7558
11	HL	6.20**	415.9974	2	207.9987
12	S(GO)	—	8952.9962	36	248.6943
13	GOH	—	111.4867	2	55.7433
14	GOL	—	114.0274	4	28.5068
15	GHL	—	65.5260	4	16.3815
16	OHL	—	15.8421	2	7.9211
17	SH(GO)	—	874.3105	36	24.2864
18	SL(GO)	—	1965.9495	72	27.3049
19	GOHL	—	208.0283	4	52.0071
20	SHL(GO)	—	2414.9895	72	33.5415

Premorbidity - G.S.R. Latency - Tones

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		117137.2048	1	117137.2048
2	G	4.90*	1001.2239	2	500.6119
3	O	—	32.3575	1	32.3575
4	H	—	173.5032	1	173.5032
5	L	5.59**	384.0334	2	192.0167
6	GO	—	264.3260	2	132.1630
7	GH	—	137.5974	2	68.7987
8	OH	—	108.4289	1	108.4289
9	GL	—	186.4268	4	46.6067
10	OL	—	32.1450	2	16.0725
11	HL	—	71.5545	2	35.7773
12	S(GO)	—	3672.8562	36	102.0238
13	GOH	—	133.1579	2	66.5789
14	GOL	—	46.3633	4	11.5908
15	GHL	—	114.6824	4	28.6706
16	OHL	—	55.5417	2	27.7708
17	SH(GO)	—	2462.8943	36	68.4137
18	SL(GO)	—	2472.2881	72	34.3373
19	GOHL	—	112.4919	4	28.1230
20	SHL(GO)	—	2332.3329	72	32.3935

Premorbidity-Algebraic Total Motor Time-Words

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		43752.0676	1	43752.0676
2	G	5.51**	40.1041	2	20.0520
3	O	—	1.1374	1	1.1374
4	H	—	0.3236	1	0.3236
5	L	5.36**	9.1573	2	4.5787
6	GO	—	0.8223	2	0.4111
7	GH	—	0.3701	2	0.1850
8	OH	—	0.3193	1	0.3193
9	GL	—	5.1352	4	1.2838
10	OL	—	0.1881	2	0.0940
11	HL	—	1.4131	2	0.7065
12	S(GO)	—	130.9148	36	3.6365
13	GOH	—	0.7920	2	0.3960
14	GOL	—	5.0301	4	1.2575
15	GHL	—	0.2609	4	0.0652
16	OHL	—	1.9858	2	0.9929
17	SH(GO)	—	33.2488	36	0.9236
18	SL(GO)	—	61.4874	72	0.8540
19	GOHL	—	0.3992	4	0.0998
20	SHL(GO)	—	51.6866	72	0.7179

Premorbidity-Algebraic Total Motor Time-Tones

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		49081.1307	1	49081.1307
2	G	—	5.3865	2	2.6933
3	O	—	0.1467	1	0.1467
4	H	—	0.4442	1	0.4442
5	L	—	0.0332	2	0.0166
6	GO	—	8.9065	2	4.4533
7	GH	—	0.0095	2	0.0047
8	OH	—	0.4112	1	0.4112
9	GL	—	0.7542	4	0.1885
10	OL	—	0.5022	2	0.2511
11	HL	—	0.2595	2	0.1298
12	S(GO)	—	93.5595	36	2.5989
13	GOH	—	0.3846	2	0.1923
14	GOL	—	0.1741	4	0.0435
15	GHL	—	0.1116	4	0.0279
16	OHL	—	0.0904	2	0.0452
17	SH(GO)	—	4.5840	36	0.1273
18	SL(GO)	—	15.5226	72	0.2156
19	GOHL	—	0.2938	4	0.0734
20	SHL(GO)	—	3.4574	72	0.0480

Premorbidity - Anticipatory Motor Time - Words

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		48350.3506	1	48350.3506
2	G		3.0376	2	1.5188
3	O		0.7557	1	0.7557
4	H		0.0048	1	0.0048
5	L	6.87**	8.0549	2	4.0275
6	GO		1.4069	2	0.7034
7	GH		0.5028	2	0.2514
8	OH		0.1781	1	0.1781
9	GL		3.5238	4	0.8810
10	OL		0.1543	2	0.0772
11	HL		1.3526	2	0.6763
12	S(GO)		70.1398	36	1.9483
13	GOH		0.3622	2	0.1811
14	GOL	3.56*	8.3490	4	2.0873
15	GHL		0.4637	4	0.1159
16	OHL		2.2555	2	1.1277
17	SH(GO)		26.0096	36	0.7225
18	SL(GO)		42.1897	72	0.5860
19	GOHL		0.5292	4	0.1323
20	SHL(GO)		39.4707	72	0.5482

Pre-morbidity-Anticipatory Motor Time - Fines

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		52518.5722	1	52518.5722
2	G	—	0.7074	2	0.3537
3	O	—	0.3108	1	0.3108
4	H	—	0.0012	1	0.0012
5	L	10.74***	0.4620	2	0.2310
6	GO	—	0.6067	2	0.3033
7	GH	—	0.0537	2	0.0268
8	OH	—	0.0072	1	0.0072
9	GL	—	0.0208	4	0.0052
10	OL	—	0.0129	2	0.0065
11	HL	—	0.0511	2	0.0255
12	S(GO)	—	11.7033	36	0.3251
13	GOH	—	0.0007	2	0.0004
14	GOL	—	0.0445	4	0.0111
15	GHL	—	0.0400	4	0.0100
16	OHL	—	0.0351	2	0.0175
17	SH(GO)	—	0.6843	36	0.0190
18	SL(GO)	—	1.5456	72	0.0215
19	GOHL	—	0.0869	4	0.0217
20	SHL(GO)	—	1.1761	72	0.0163

Premorbidity - Motor Reaction Time - Words

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		492.8006	1	492.8006
2	G	—	50.6973	2	25.3487
3	O	—	37.1067	1	37.1067
4	H	6.55*	6.2859	1	6.2859
5	L	10.30***	31.8510	2	15.9255
6	GO	—	7.4356	2	3.7178
7	GH	—	2.3650	2	1.1825
8	OH	—	0.1032	1	0.1032
9	GL	—	6.0001	4	1.5000
10	OL	—	0.7938	2	0.3969
11	HL	—	4.5074	2	2.2537
12	S(GO)	—	397.2811	36	11.0356
13	GOH	—	0.5147	2	0.2573
14	GOL	—	4.4827	4	1.1207
15	GHL	—	10.6059	4	2.6515
16	OHL	—	4.6654	2	2.3327
17	SH(GO)	—	34.4976	36	0.9583
18	SL(GO)	—	111.2902	72	1.5457
19	GOHL	—	2.3129	4	0.5782
20	SHL(GO)	—	117.9261	72	1.6379

Premorbidity - Motor Reaction Time - Jones

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
	F			
1	MEAN	52.5258	1	52.5258
2	G	1.3008	2	0.6504
3	O	0.0822	1	0.0822
4	H	0.0072	1	0.0072
5	L	0.0043	2	0.0022
6	GO	0.9347	2	0.4673
7	GH	0.1165	2	0.0582
8	OH	0.0394	1	0.0394
9	GL	0.1149	4	0.0287
10	OL	0.2518	2	0.1259
11	HL	0.0162	2	0.0081
12	S(GO)	17.9987	36	0.5000
13	GOH	0.0108	2	0.0054
14	GOL	0.0915	4	0.0229
15	GHL	0.0319	4	0.0080
16	OHL	0.0829	2	0.0415
17	SH(GO)	1.4749	36	0.0410
18	SL(GO)	4.2167	72	0.0586
19	GOHL	0.1245	4	0.0311
20	SHL(GO)	1.8769	72	0.0261

Premorbidity - Positive Motor Time - ~~Forms~~ Words

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		132.9945	1	132.9945
2	G	6.68**	21.9604	2	10.9802
3	O	—	0.1560	1	0.1560
4	H	—	0.1590	1	0.1590
5	L	—	0.0125	2	0.0063
6	GO	—	0.5448	2	0.2724
7	GH	—	0.7099	2	0.3549
8	OH	—	0.0000	1	0.0000
9	GL	—	0.1548	4	0.0387
10	OL	—	0.3503	2	0.1752
11	HL	—	0.0030	2	0.0015
12	S(GO)	—	59.2014	36	1.6445
13	GOH	—	0.2020	2	0.1010
14	GOL	—	0.3445	4	0.0861
15	GHL	—	0.2969	4	0.0742
16	OHL	—	0.0638	2	0.0319
17	SH(GO)	—	5.2159	36	0.1449
18	SL(GO)	—	9.0686	72	0.1260
19	GOHL	—	0.2028	4	0.0507
20	SHL(GO)	—	6.3226	72	0.0878

Premorbidity - Positive Motor Time - ~~Words~~ Forms

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		217.8060	1	217.8060
2	G	—	3.3944	2	1.6972
3	O	—	0.0031	1	0.0031
4	H	—	0.2527	1	0.2527
5	L	—	0.4687	2	0.2343
6	GO	—	4.7089	2	2.3544
7	GH	—	0.0503	2	0.0252
8	OH	—	0.3059	1	0.3059
9	GL	—	1.1132	4	0.2783
10	OL	—	0.2941	2	0.1471
11	HL	—	0.1143	2	0.0572
12	S(GO)	—	56.8507	36	1.5792
13	GOH	—	0.3416	2	0.1708
14	GOL	—	0.0261	4	0.0065
15	GHL	—	0.0530	4	0.0132
16	OHL	—	0.1465	2	0.0733
17	SH(GO)	—	3.2239	36	0.0896
18	SL(GO)	—	13.0194	72	0.1808
19	GOHL	—	0.0976	4	0.0244
20	SHL(GO)	—	2.6728	72	0.0371

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Premorbidity - Total Motor Time - Words

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		913.3336	1	913.3336
2	G	—	8.9170	2	4.4585
3	O	—	1.8088	1	1.8088
4	H	—	0.0201	1	0.0201
5	L	5.82**	7.1361	2	3.5680
6	GO	—	4.6450	2	2.3225
7	GH	—	2.7176	2	1.3588
8	OH	—	0.1267	1	0.1267
9	GL	—	2.5675	4	0.6419
10	OL	—	0.1876	2	0.0938
11	HL	—	2.0737	2	1.0369
12	S(GO)	—	119.7978	36	3.3277
13	GOH	—	0.7998	2	0.3999
14	GOL	5.55**	13.6175	4	3.4044
15	GHL	—	0.8913	4	0.2228
16	OHL	—	1.9123	2	0.9561
17	SH(GO)	—	34.6894	36	0.9636
18	SL(GO)	—	44.1492	72	0.6132
19	GOHL	—	2.5804	4	0.6451
20	SHL(GO)	—	38.4629	72	0.5342

Premorbidity - Total Motor Time - Tones

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		563.0170	1	563.0170
2	G	—	2.3890	2	1.1945
3	O	—	0.0296	1	0.0296
→ 4	H	—	0.3337	1	0.3337
→ 5	L	4.40*	1.7515	2	0.8758
6	GO	—	1.6118	2	0.8059
7	GH	—	0.0865	2	0.0433
→ 8	OH	—	0.2914	1	0.2914
9	GL	—	0.8083	4	0.2021
10	OL	—	0.4307	2	0.2153
11	HL	—	0.0660	2	0.0330
12	S(GO)	—	43.5265	36	1.2091
13	GOH	—	0.3509	2	0.1755
14	GOL	—	0.0479	4	0.0120
15	GHL	—	0.1777	4	0.0444
→ 16	OHL	4.50*	0.4031	2	0.2015
17	SH(GO)	—	2.9207	36	0.0811
18	SL(GO)	—	14.3196	72	0.1989
19	GOHL	—	0.0353	4	0.0088
20	SHL(GO)	—	3.2265	72	0.0448

Premorbidity-Reaction Time to Words - Words

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		1760.1429	1	1760.1429
2	G		73.9502	2	36.9751
3	O		71.4668	1	71.4668
4	H		0.4629	1	0.4629
5	L	15.73***	82.0950	2	41.0475
6	GO		27.3082	2	13.6541
7	GH		0.4660	2	0.2330
8	OH		0.9411	1	0.9411
9	GL		10.4376	4	2.6094
10	OL		0.4158	2	0.2079
11	HL		4.1717	2	2.0858
12	S(GO)		1145.8986	36	31.8305
13	GOH		0.8667	2	0.4334
14	GOL		19.6092	4	4.9023
15	GHL		14.8681	4	3.7170
16	OHL		4.3953	2	2.1977
17	SH(GO)		48.3433	36	1.3429
18	SL(GO)		188.0357	72	2.6116
19	GOHL		17.1683	4	4.2921
20	SHL(GO)		209.2567	72	2.9065

Premorbidity - Respiration Rate Change - Words

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	E	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		2866.1191	1	2866.1191
2	G		0.1149	2	0.0575
3	O		0.1729	1	0.1729
4	H		0.0232	1	0.0232
5	L		0.0741	2	0.0371
6	GO		0.3433	2	0.1717
7	GH		0.0018	2	0.0009
8	OH		0.0134	1	0.0134
9	GL		0.4056	4	0.1014
10	OL		0.1960	2	0.0980
11	HL		0.0830	2	0.0415
12	S(GO)		3.9323	36	0.1092
13	GOH		0.0097	2	0.0048
14	GOL		0.4259	4	0.1065
15	GHL		0.5277	4	0.1319
16	OHL		0.2427	2	0.1213
17	SH(GO)		0.7894	36	0.0219
18	SL(GO)		3.4615	72	0.0481
19	GOHL		0.3672	4	0.0918
20	SHL(GO)		6.7462	72	0.0937

Premorbidity - Respiration Rate Change - Tones

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		2828.9411	1	2828.9411
2	G	—	0.0218	2	0.0109
3	O	—	0.0052	1	0.0052
4	H	—	0.0148	1	0.0148
5	L	—	0.0410	2	0.0205
6	GO	—	0.0787	2	0.0394
7	GH	4.77*	0.7377	2	0.3689
8	OH	—	0.0058	1	0.0058
9	GL	—	0.0791	4	0.0198
10	OL	—	0.1329	2	0.0665
11	HL	—	0.2698	2	0.1349
12	S(GO)	—	0.8347	36	0.0232
13	GOH	—	0.1057	2	0.0529
14	GOL	—	0.3753	4	0.0938
15	GHL	—	0.0957	4	0.0239
16	OHL	3.34*	0.2820	2	0.1410
17	SH(GO)	—	2.7827	36	0.0773
18	SL(GO)	—	3.8781	72	0.0539
19	GOHL	—	0.0793	4	0.0198
20	SHL(GO)	—	3.0411	72	0.0422

Premorbidity - Respiration Rate - Wards

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE	F	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		96773.0432	1	96773.0432
2	G	—	368.5638	2	184.2819
3	O	—	37.8781	1	37.8781
4	H	5.54*	57.6200	1	57.6200
5	L	—	5.1907	2	2.5954
6	GO	—	146.3708	2	73.1854
7	GH	—	34.4613	2	17.2306
8	OH	—	2.1175	1	2.1175
9	GL	—	14.2205	4	3.5551
10	OL	—	9.4815	2	4.7408
11	HL	—	5.4901	2	2.7450
12	S(GO)	—	6172.5590	36	171.4600
13	GOH	—	5.5914	2	2.7957
14	GOL	—	18.5092	4	4.6273
15	GHL	—	41.5640	4	10.3910
16	OHL	—	16.0736	2	8.0368
17	SH(GO)	—	374.0648	36	10.3907
18	SL(GO)	—	322.6681	72	4.4815
19	GOHL	—	10.7000	4	2.6750
20	SHL(GO)	—	417.7224	72	5.8017

Premorbidity - Poststimulus Respiration Rate ~~Poststimulus~~ - Tones

ANALYSIS OF VARIANCE FOR DEPENDENT VARIABLE 1

	SOURCE		SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE
1	MEAN		959.6345	1	959.6345
		E			
2	G		5.3317	2	2.6658
3	O		0.1535	1	0.1535
4	H		0.1372	1	0.1372
5	L		0.0205	2	0.0102
6	GO		0.5534	2	0.2767
7	GH	6.14**	0.4725	2	0.2363
8	OH		0.0149	1	0.0149
9	GL		0.1977	4	0.0494
10	OL		0.1623	2	0.0811
11	HL		0.0805	2	0.0403
12	S(GO)		37.1706	36	1.0325
13	GOH		0.0310	2	0.0155
14	GOL	3.69**	0.2359	4	0.0590
15	GHL		0.0397	4	0.0099
16	OHL		0.1394	2	0.0697
17	SH(GO)		1.3864	36	0.0385
18	SL(GO)		3.6068	72	0.0501
19	GOHL		0.0591	4	0.0148
20	SHL(GO)		1.1512	72	0.0160

Appendix E

Comparisons of Variances of the Subjects Within the Good Premorbid, Poor Premorbid, and Normal Control Groups for all Measures Examined

Initial Conductance Level

Source of Variance	df	Mean Square C^{a}	Mean Square G^{b}	Mean Square P^{c}	Ratio C/G	Ratio C/P	Ratio G/P
S	13	15.8	6.06	14.1	2.61	1.12	2.32

a C = Normal Controls
b G = GPM Schizophrenics
c P = PPM Schizophrenics

GSR for Word Stimuli[a]

Mean Square / Ratio

Source of Variance	df	C[b]	G[c]	P[d]	C/G	C/P	G/P
S/O	12	123	79.6	44.1	1.54	2.79*	1.80
SH/O	12	16.9	11.9	4.09	1.42	4.13**	2.91*
SL/O	24	10.5	4.07	6.77	2.58*	1.55	1.66
SHL/O	24	9.07	3.84	2.21	2.36*	4.10**	1.74

GSR for Sound Stimuli[a]

Mean Square / Ratio

Source of Variance	df	C	G	P	C/G	C/P	G/P
S/O	12	259	168	93.8	1.54	2.76*	1.79
SH/O	12	24.2	29.5	32.3	1.22	1.33	1.09
SL/O	24	78.8	51.7	56.7	1.52	1.39	1.10
SHL/O	24	13.4	44.3	36.3	3.31**	2.71**	1.22

a (All) mean squares of this measure multiply by 10^6

b C = Normal Controls
c G = GPM Schizophrenics
d P = PPM Schizophrenics

* Significant at <.05 level
** Significant at <.01 level

Source of Variance	D.F.	Mean Square C	G	P	Ratios C/G	C/P	G/P
S/0	12	0	0	0	—	—	—
SH/0	12	.025	.032	.024	1.28	1.04	1.33
SL/0	24	.007	.029	.025	4.14**	3.57**	1.10
SHL/0	24	.009	.021	.025	2.33*	2.78**	1.19

Rank Order of G×S.R. Tones

Source of Variance	D.F.	Mean Square C	G	P	Ratio C/G	C/P	G/P
S/0	12	0	0	0	—	—	—
SH/0	12	.006	.012	.012	2.00	2.00	1.00
SL/0	24	.008	.010	.007	1.25	1.14	1.43
SHL/0	24	.009	.012	.005	1.33	1.80	2.40*

*Significant at < .05 Level
**Significant at < .01 Level

Source of Variance	D.F.	Mean Square C	G	P	Ratio C/G	C/P	G/P
S/o	12	102	486	192	4.76**	1.88	2.53
SH/o	12	15.5	19.6	27.8	1.26	1.79	1.42
SL/o	24	11.6	41.4	26.7	3.57**	2.30*	1.55
SHL/o	24	12.4	18.7	67.0	1.40	5.0**	3.58*

G.S.R. Latency - Tones

Source of Variance	D.F.	Mean Squares C	G	P	Ratio C/G	C/P	G/P
S/o	12	95	173	122	1.82	1.28	1.42
SH/o	12	16.2	73.6	107	4.54**	6.60**	1.45
SL/o	24	9.95	47.7	26.1	4.79**	2.62**	1.83
SHL/o	24	6.56	37	30.2	5.64**	4.60**	1.23

* Significant at < .05 Level
** Significant at < .01 Level

Source of Variance	D.F.	Mean Square C	Mean Square G	Mean Square P	Ratio C/G	Ratio C/P	Ratio G/P
S/0	12	6.81	23.9	12.8	3.51*	1.88	1.87
SH/0	12	3.82	3.07	1.27	1.24	3.01*	2.42
SL/0	24	2.53	3.63	1.51	1.43	1.68	2.40
SHL/0	24	2.18	2.48	.990	1.14	2.20*	2.51*

GSR Recruitment - Tones

Source of Variance	D.F.	Mean Square C	Mean Square G	Mean Square P	Ratio C/G	Ratio C/P	Ratio G/P
S/0	12	19.3	44.6	29.0	2.31	1.50	1.54
SH/0	12	1.37	4.49	6.48	3.28*	4.73**	1.44
SL/0	24	1.40	1.83	2.24	1.31	1.60	1.22
SHL/0	24	1.00	1.78	1.56	1.78	1.56	1.14

* Significant at .05 Level
** Significant at <.01 Level

Basal Level – Words[a]

Source of Variance	df	Mean Square: C	Mean Square: G	Mean Square: P	Ratio: C/G	Ratio: C/P	Ratio: G/P
S/0	12	148	57.3	58.9	2.58	2.51	1.03
SH/0	12	2.12	.396	.677	5.35**	3.13	1.71
SL/0	24	.066	.056	.054	1.18	1.22	1.04
SHL/0	24	.067	.078	.050	1.16	1.34	1.56

Basal Level – Tones[a]

Source of Variance	df	Mean Square: C	Mean Square: G	Mean Square: P	Ratio: C/G	Ratio: C/P	Ratio: G/P
S/0	12	132	62.2	72.6	2.12	1.82	1.17
SH/0	12	.608	.581	.443	1.05	1.37	1.31
SL/0	24	.124	.203	.211	1.64	1.70	1.04
SHL/0	24	.059	.086	.190	1.46	1.19	2.21*

[a] All mean squares of this measure multiply by 10^8

* Significant at <.05 Level
** Significant at <.01 Level

Basal Level Change - Words[a]

Mean Square | Ratio

Source of Variance	df	C	G	P	C/G	C/P	G/P
S/O	12	30.5	28.0	60.7	1.09	1.99	2.17
SH/O	12	27.7	9.09	14.9	3.04*	1.86	1.64
SL/O	24	71.9	19.1	50.8	3.76**	1.42	2.66**
SHL/O	24	89.0	24.2	16.8	3.68**	5.30**	1.44

Basal Level Change - Tones[a]

Mean Square | Ratio

Source of Variance	df	C	G	P	C/G	C/P	G/P
S/O	12	25.1	91.3	24.6	2.75*	1.02	2.69*
SH/O	12	46.2	69.9	25.1	1.51	1.84	2.78*
SL/O	24	144	128	209	1.13	1.45	1.63
SHL/O	24	40.6	116	189	2.86**	4.66**	1.63

a All mean squares of this measure multiply by 10^5

* Significant at < .05 Level

** Significant at < .01 Level

Time to Basal Level – Words

Source of Variance	df	C	G	P	C/G	C/P	G/P
S/0	12	56.1	215	319	3.83*	5.69**	1.48
SH/0	12	8.55	19.2	31.4	2.25	3.67*	1.64
SL/0	24	7.23	15.2	20.3	2.10*	2.81**	1.34
SHL/0	24	17.4	12.1	14.4	1.44	1.21	1.19

(Mean Square: C, G, P; Ratio: C/G, C/P, G/P)

Time to Basal Level – Tones

Source of Variance	df	C	G	P	C/G	C/P	G/P
S/0	12	63.1	67.1	249	1.06	3.95*	3.71*
SH/0	12	10.9	74.5	51.8	6.83**	4.75**	1.44
SL/0	24	20.6	10.1	26.4	2.04*	1.28	2.61*
SHL/0	24	5.93	19.8	23.8	3.34**	4.01**	1.20

(Mean Square: C, G, P; Ratio: C/G, C/P, G/P)

* Significant at < .05 Level
** Significant at < .01 Level

Verbal Reaction Time to Word Stimulus

Source of Variance	D.F.	Mean Square C	Mean Square G	Mean Square P	Ratio C/G	Ratio C/P	Ratio G/P
S/o	12	7.57	4.22	21.54	1.79	2.85*	5.10**
SH/o	12	.789	2.15	1.09	2.72*	1.38	1.97
SL/o	24	.828	2.94	4.07	3.54**	4.90**	1.38
SHL/o	24	2.10	3.16	3.46	1.50	1.65	1.09

* Significant at ≤.05 Level
** Significant at ≤.01 Level

Source of Variance	D.F.	Mean Square C	Mean Square G	Mean Square P	Ratio C/G	Ratio C/P	Ratio G/P
S/0	12	.919	5.67	3.32	6.17**	3.61*	1.71
SH/0	12	.352	1.84	.580	5.23**	1.65	3.17*
SL/0	24	.378	.999	1.19	2.64*	3.15**	1.19
SHL/0	24	.319	.955	.880	2.99**	2.76**	1.09

Algebraic Total Motor Time - Tones

Source of Variance	D.F.	Mean Square C	Mean Square G	Mean Square P	Ratio C/G	Ratio C/P	Ratio G/P
S/0	12	2.82	3.31	1.67	1.17	1.69	1.98
SH/0	12	.058	.163	.161	2.81*	2.78*	1.01
SL/0	24	.115	.053	.479	2.17*	4.17**	9.04**
SHL/0	24	.035	.032	.077	1.09	2.20*	2.41*

* Significant at <.05 Level
** Significant at <.01 Level

Source of Variance	D.F.	Mean Square C	G	P	Ratio C/G	C/P	G/P
S/o	12	.993	3.61	1.24	3.64*	1.25	2.91*
SH/o	12	.259	1.46	.415	5.05**	1.44	3.52*
SL/o	24	.297	.868	.593	2.92**	2.00*	1.46
SHL/o	24	.258	.917	.469	3.56**	1.82	1.96

Anticapatory Motor Time - Tones

Source of Variance	D.F.	Mean Square C	G	P	Ratio C/G	C/P	G/P
S/o	12	.185	.357	.433	1.93	2.34	1.21
SH/o	12	.013	.022	.022	1.69	1.69	1.00
SL/o	24	.027	.020	.017	1.35	1.59	1.18
SHL/o	24	.012	.014	.024	1.17	2.00*	1.71

* Significant at < .05 Level
** Significant at < .01 Level

Source of Variance	Mean Square D.F.	C	G	P	Ratio C/G	C/P	G/P
S/o	12	7.57	5.69	19.6	1.33	2.59	3.44*
SH/o	12	.217	1.29	1.41	5.86**	6.41**	1.09
SL/o	24	.627	1.39	2.60	2.21*	4.13**	1.87
SHL/o	24	1.28	1.55	2.13	1.21	1.66	1.37

Motor Reaction Time - Tones

Source of Variance	Mean Square D.F	C	G	P	Ratio C/G	C/P	G/P
S/o	12	.228	.643	.629	2.82*	2.76*	1.02
SH/o	12	.045	.045	.033	1.00	1.36	1.36
SL/o	24	.034	.112	.029	3.29**	1.17	3.86**
SHL/o	24	.016	.028	.035	1.75	2.19*	1.25

* Significant at < .05 Level
** Significant at < .01 Level

Source of Variance	D.F.	Mean Square C	G	P	Ratio C/G	C/P	G/P
S/0	12	2.37	2.47	5.14	1.04	2.17	2.08
SH/0	12	.435	1.49	.965	3.43**	2.22	1.54
SL/0	24	.394	.883	.563	2.24*	1.43	1.57
SHL/0	24	.296	.943	.364	3.19**	1.23	2.59*

Total Motor Time - Tones

Source of Variance	D.F.	Mean Square C	G	P	Ratio C/G	C/P	G/P
S/0	12	1.24	1.18	1.21	1.05	1.02	1.03
SH/0	12	.081	.079	.084	1.03	1.04	1.06
SL/0	24	.063	.031	.502	2.03*	7.97**	16.19**
SHL/0	24	.046	.049	.040	1.07	1.15	1.23

* Significant at < .05 Level
** Significant at < .01 Level

Source of Variance	D.F	Mean Square C	G	P	Ratio C/G	C/P	G/P
S/0	12	.042	.042	.243	1.00	5.79**	5.79**
SH/0	12	.025	.016	.025	1.56	1.00	1.56
SL/0	24	.019	.013	.112	1.46	5.89**	8.62**
SHL/0	24	.013	.016	.252	1.23	19.38**	15.75**

Respiration Rate Change-Tones

Source of Variance	D.F.	Mean Square C	G	P	Ratio C/G	C/P	G/P
S/0	12	.029	.015	.026	1.93	1.11	1.73
SH/0	12	.069	.016	.147	4.31**	2.13	9.19**
SL/0	24	.030	.015	.118	2.00*	3.93**	7.87**
SHL/0	24	.025	.016	.086	1.56	3.44**	5.38**

* Significant at < .05 Level
** Significant at < .01 Level

Poststimulus Respiration Rate — Words

Source of Variance	df	C	G	P	C/G	C/P	G/P
		Mean Square			Ratio		
S/0	12	113	70.0	331	1.61	2.93*	4.73**
SH/0	12	2.33	1.34	27.5	1.74	11.8**	20.5**
SL/0	24	4.00	.602	8.84	6.67**	2.21*	14.7**
SHL/0	24	1.32	1.46	14.6	1.11	11.1**	10.0*

Poststimulus Respiration Rate—Tones

Source of Variance	df	C	G	P	C/G	C/P	G/P
		Mean Square			Ratio		
S/0	12	75.2	80.9	154	1.08	2.05	1.90
SH/0	12	6.21	1.35	4.00	4.60**	1.55	2.96*
SL/0	24	1.22	.994	12.8	1.23	10.5**	12.9**
SHL/0	24	1.81	.642	2.35	2.83**	1.30	3.67**

* Significant at < .05 Level
** Significant at < .01 Level